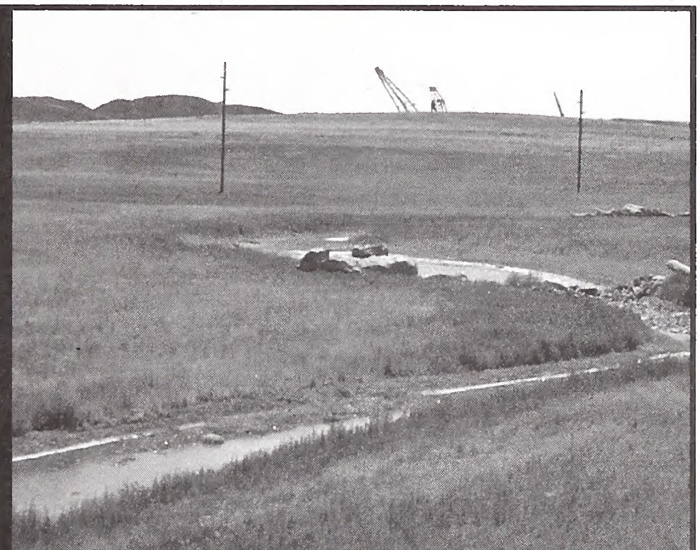
FINAL
Environmental Impact Statement for the South Gillette Area Coal Lease Applications
WYW172585, WYW173360, WYW172657, WYW161248

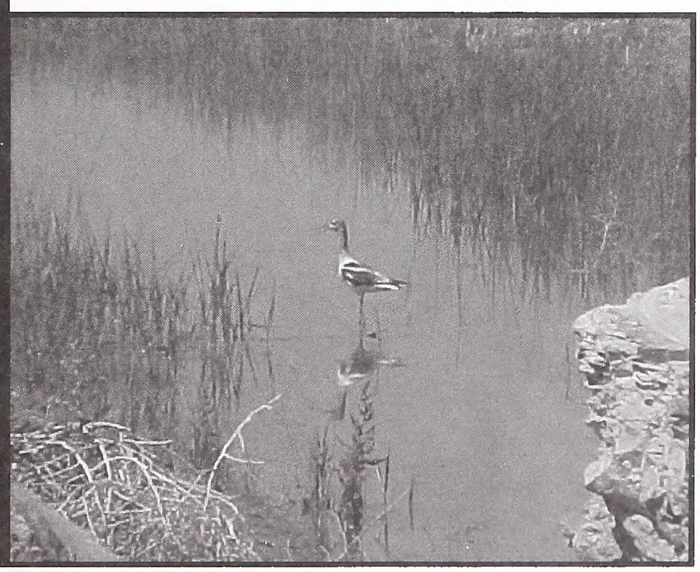
Volume 1 of 2
Chapters 1 – 8

Mule Deer on Reclaimed Rangeland
Coal Creek Mine, Wyoming



Reclaimed Belle Fourche River
Cordero Rojo Mine, Wyoming

Reclaimed Tisdale Creek
Caballo Mine, Wyoming



American Avocet in a Reclaimed Wetland
Belle Ayr Mine, Wyoming

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
NATIONAL SYSTEM OF PUBLIC LANDS

August 2009

BLM

Wyoming State Office – High Plains District

MISSION STATEMENT

It is the mission of the Bureau of Land Managment to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

BLM/WY/PL-09/029+1320

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82003-1828

TAKE PRIDE® IN AMERICA

In Reply Refer To:
3425 (LBA)
WY922 (Love)
WYW172657 (Caballo West LBA)
WYW161248 (Belle Ayr North LBA)
WYW173360 (Maysdorf II LBA)
WYW172585 (West Coal Creek LBA)
South Gillette Area Coal EIS

AUG 0 5 2009

Dear Reader:

The Bureau of Land Management (BLM) has prepared this final environmental impact statement (FEIS) to document and disclose the results of environmental analyses of four applications received by the BLM to lease tracts of Federal coal. The tracts are located in the South Gillette Area of the Wyoming Powder River Basin at the Caballo, Belle Ayr, Cordero Rojo, and Coal Creek mines. A copy of this document is provided for your review and comments. The FEIS may also be reviewed at the following website:

http://www.blm.gov/wy/st/en/info/NEPA/cfodocs/south_gillette.html

Copies of the FEIS are also available for public inspection at the following BLM offices:

Bureau of Land Management
Wyoming State Office
5353 Yellowstone Road
Cheyenne, WY 82009

Bureau of Land Management
High Plains District Office
2987 Prospector Drive
Casper, Wyoming 82604

The draft environmental impact statement (DEIS) was published in October 2008 and the 60-day comment period on the DEIS ended on December 24, 2008. A formal public hearing on these applications to lease Federal coal was held at 7:00 p.m. on November 19, 2008, at the George Amos Memorial Building, 412 South Gillette Avenue, Gillette, Wyoming. The purpose of the hearing was to receive comments on the DEIS, on the fair market value, and on the maximum economic recovery of the Federal coal resources included in the tracts.

The BLM has prepared a separate document entitled *Supplementary Information on the Affected Environment in the General Analysis Area for the South Gillette Area Coal Lease Application EIS* in addition to this FEIS. This document, which is available on

request, includes more detailed site-specific information about the potentially affected resources included in the study areas for the South Gillette Area tracts.

The BLM will accept public comments on this FEIS for thirty (30) days commencing on the date the Environmental Protection Agency publishes its Notice of Availability in the Federal Register. Comments received after the end of the 30-day comment period will be considered in preparation of the Record of Decision (ROD) as time permits. The BLM is also publishing a Notice of Availability in the Federal Register.

If you wish to comment on the FEIS, your comments should relate directly to the document. Comments should be as specific as possible and the location or locations in the document on which you are commenting should be cited. The agencies involved in preparing this FEIS are required to respond in the ROD to all substantive comments submitted. Substantive comments should: (1) give any new information that could alter conclusions; (2) show why or how analysis or assumptions in the FEIS are flawed; (3) show errors in data, sources, or methods; or, (4) request clarifications that bear on conclusions. Opinions or preferences will not receive a formal response, but they will be considered and included as part of the BLM decisionmaking process.

This FEIS was prepared pursuant to the National Environmental Policy Act and applicable regulations, and other applicable statutes, to address possible environmental and socioeconomic impacts that could result from this project. This FEIS is not a decision document. Its purpose is to inform the public and the agency decisionmakers of the impacts of leasing some or all of the South Gillette Area tracts of Federal coal to the existing applicant mines in the Wyoming Powder River Basin and to evaluate alternatives to leasing the Federal coal included in the tracts as applied for.

Comments, including names and addresses of respondents, will be available for public review at the address listed below during regular business hours (7:45 a.m. to 4:30 p.m.), Monday through Friday, except holidays, and will be published as part of the ROD. Individual respondents may request confidentiality. If you wish to withhold your name or address from public review or from disclosure under the Freedom of Information Act, you must state this prominently at the beginning of your written comment. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

Please send written comments to: Bureau of Land Management, Wyoming High Plains District Office, Attn: Teresa Johnson, 2987 Prospector Drive, Casper, WY 82604. Written comments may also be e-mailed to the attention of Teresa Johnson at "casper_wymail@blm.gov". E-mail comments must include the name and mailing address of the commentor to receive consideration. Written comments may also be faxed to (307)-261-7587.

If you have any questions or would like to obtain a copy of the supplementary information document or additional copies of this FEIS in either hard copy or PDF, please contact Teresa Johnson at (307) 261-7510, or at the above address.

Sincerely,

Donald A. Simpson
State Director

FINAL ENVIRONMENTAL IMPACT STATEMENT
SOUTH GILLETTE AREA COAL LBA TRACTS
CAMPBELL COUNTY, WYOMING

Lead Agency: USDI, Bureau of Land Management, Casper Field Office, Casper, WY

Cooperating Agencies: USDI, Office of Surface Mining Reclamation and Enforcement Western Region, Denver, CO

Wyoming Department of Transportation, Cheyenne, WY

Wyoming Department of Environmental Quality, Cheyenne, WY

Wyoming State Planning Office, Cheyenne, WY

Abstract: This Final Environment Impact Statement (FEIS) assesses the environmental consequences of decisions to hold competitive, sealed-bid sales and issue leases for several tracts of federal coal located adjacent to existing surface coal mines in Campbell County, Wyoming, subject to standard and special lease stipulations. The South Gillette Area Coal Lease by Application (LBA) Tracts, as applied for by Foundation Coal West, Ark Land Company, Caballo Coal Company, and Cordero Mining Company, include approximately 8,161.025 acres containing approximately 827 million tons of in-place Federal coal. The four coal companies, operators of the adjacent Belle Ayr Mine, the adjacent Coal Creek Mine, the adjacent Caballo Mine, and the adjacent Cordero-Rojo Mine respectively, propose to mine the tracts as maintenance leases for the existing mines, if lease sales are held and they acquire the leases.

This final EIS describes the physical, biological, cultural, historic, and socioeconomic resources in and around the existing mines and the LBA tracts. The alternatives in the final EIS consider the impacts of leasing the tracts as they were applied for; leasing reconfigured tracts in order to avoid bypassing Federal coal or to increase competitive interest in a tract, and not leasing the tracts. The focus for the impact analysis was based upon resource issues and concerns identified during previous coal leasing analyses and public scoping conducted for these lease applications. Concerns related to leasing coal and its subsequent development include impacts to groundwater, air quality, wildlife, global climate change, impacts to human health, conflicts with oil and gas development, impacts to cultural and paleontological resources, impacts to wetland resources, nitrogen oxide emissions resulting from blasting of coal and overburden, access to county roads, and impacts from coal transport. Cumulative impacts related to ongoing surface coal mining and other proposed development in the Powder River

Basin of Wyoming, and coal combustion residues and other by-products from coal-fired power plants, are also of concern.

This final EIS, in compliance with Section 7(c) of the Endangered Species Act (as amended), identifies any endangered or threatened species which are likely to be affected by the Proposed Action.

The final EIS is open for a 30-day review period beginning on the date that the U.S. Environmental Protection Agency publishes the Notice of Availability in the *Federal Register*. Comments that are postmarked or received on or before the end of the 30-day review period will be considered in the preparation of the ROD.

For Further Information Contact:

Teresa Johnson
Bureau of Land Management
Casper Field Office
2987 Prospector Drive
Casper, WY 82604
(307) 261-7627
Email: casper_wymail@blm.gov (Teresa Johnson in the subject line)

SOUTH GILLETTE AREA COAL LEASE APPLICATIONS
FINAL ENVIROMENTAL IMPACT STATEMENT

Prepared by

WWC Engineering
Sheridan, Wyoming

Under the Direction of

U.S. Department of the Interior
Bureau of Land Management
High Plains District Office
Casper, Wyoming

and

Cooperating Agencies

U.S. Department of Interior
Office of Surface Mining
Reclamation and Enforcement
Denver, Colorado

and

Wyoming Department of Environmental Quality
Cheyenne, Wyoming

and

Wyoming Department of Transportation
Sheridan, and Cheyenne, Wyoming

August 2009

EXECUTIVE SUMMARY

This environmental impact statement (EIS)[1] analyzes the environmental impacts of leasing four tracts of federal coal reserves adjacent to the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines. All are operating surface coal mines in the east-central Powder River Basin (PRB) of Wyoming. The operators of the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines filed four applications to lease the four tracts of federal coal included in maintenance coal tracts (federal coal tracts that would continue or extend the life of an existing coal mine) under the regulations at 43 CFR 3425, Leasing On Application. Figure ES-1 shows the four LBA tracts, other currently pending LBA tracts, and the existing federal leases, including previously leased LBA tracts, in the Wyoming PRB.

On July 6, 2004, RAG Coal West, Inc. (RAG) filed an application with the Bureau of Land Management (BLM) to lease federal coal reserves in a tract north of and immediately adjacent to the Belle Ayr Mine in Campbell County, Wyoming, approximately 10 miles south-southeast of Gillette (figures ES-1 and ES-2). The tract, which was originally referred to as the Belle Ayr Mine North Extension lease by application (LBA) Tract, was assigned case file number WYW161248. The federal coal reserves were applied for as a maintenance tract for the Belle Ayr Mine. BLM subsequently renamed the tract the Belle Ayr North LBA tract. In August 2004, RAG finalized the sale of the Belle Ayr Mine to Foundation Coal West (FCW), a directly held subsidiary of Foundation Coal Holdings, Inc. In this EIS, the applicant for the Belle Ayr North LBA tract will be referred to as FCW.

On February 10, 2006, Ark Land Company (ALC) filed an application with BLM to lease the federal coal reserves in a tract west of and immediately adjacent to the Coal Creek Mine in Campbell County, Wyoming, approximately 25 miles south-southeast of Gillette (figures ES-1 and ES-3). The tract, which is referred to as the West Coal Creek LBA tract, was assigned case number WYW172585. The federal coal reserves were applied for as a maintenance tract for the Coal Creek Mine. ALC is a wholly owned subsidiary of Arch Coal, Inc. Thunder Basin Coal Company (TBCC), a subsidiary of Arch Western Resources, LLC, operates the Coal Creek Mine. In this EIS, ALC is referred to as the applicant, and TBCC is referred to in discussions of mine operations.

On March 15, 2006, Caballo Coal Company (CCC) filed an application with BLM to lease the federal coal included in a tract located west of and immediately adjacent to the Caballo Mine in Campbell County, Wyoming, approximately 8 miles south-southeast of Gillette (figures ES-1 and ES-4). The tract, which is referred to as the Caballo West LBA tract, was assigned case number WYW172657. The federal coal reserves were applied for as a maintenance tract for the Caballo Mine. CCC is a directly held subsidiary of Peabody Holding Company, Inc., which in turn is a directly held subsidiary of Peabody Energy Corporation.

1 Refer to page xxiii for a list of abbreviations and acronyms used in this document.

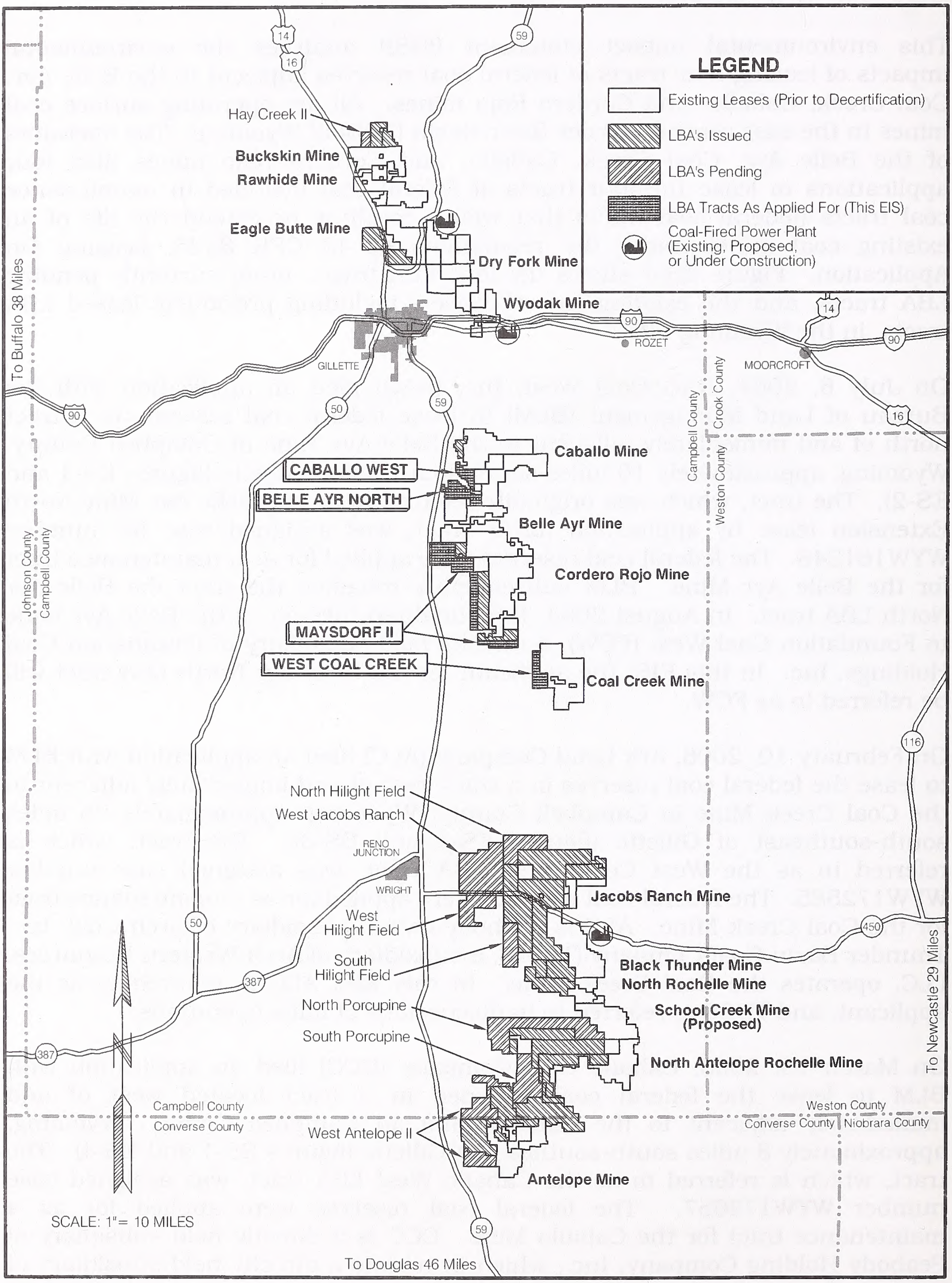


Figure ES-1. General Location Map with Federal Coal Leases and LBA Tracts.

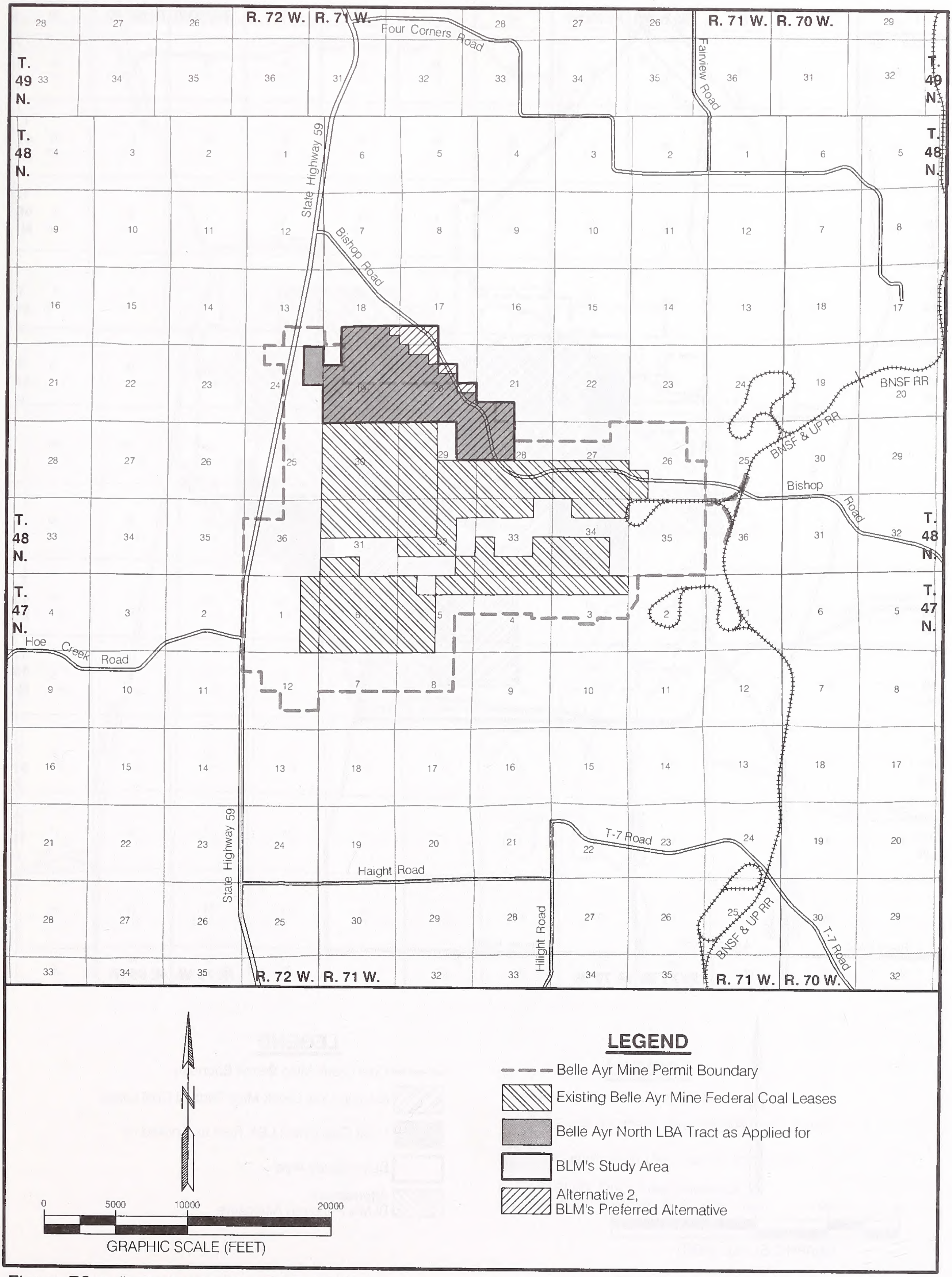


Figure ES-2. Belle Ayr North LBA Tract Alternatives.

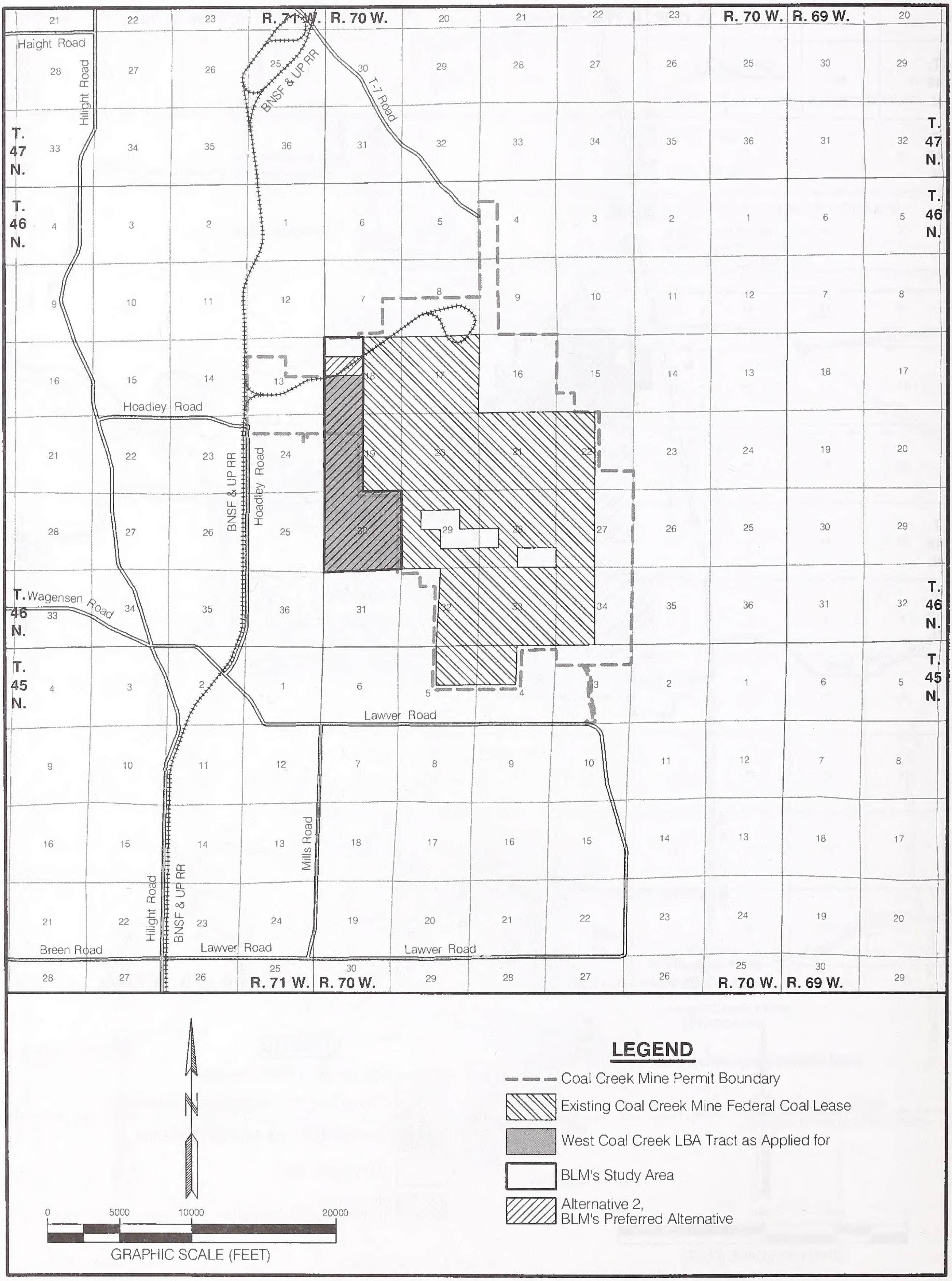


Figure ES-3. West Coal Creek LBA Tract Alternatives.

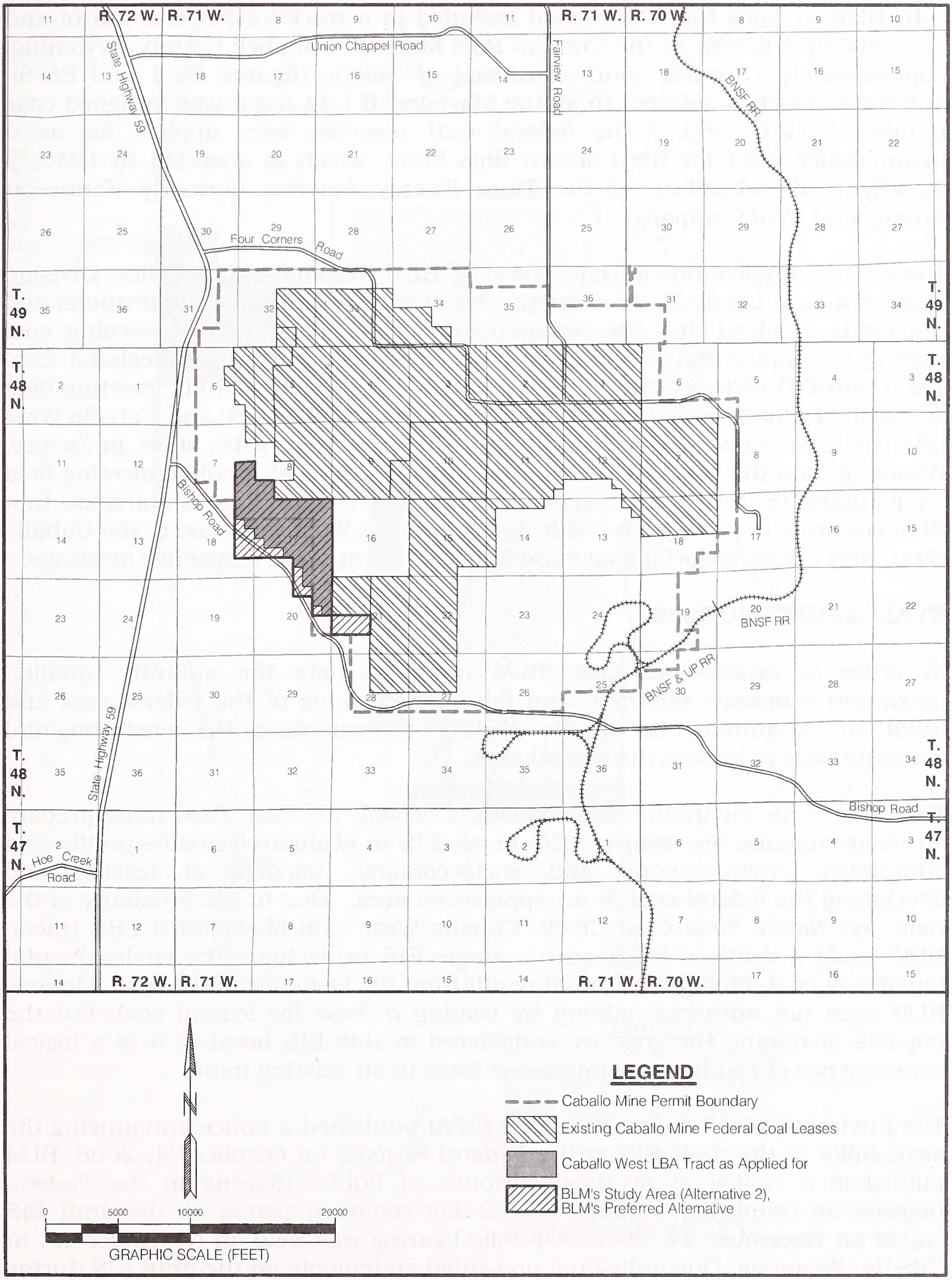


Figure ES-4. Caballo West LBA Tract Alternatives.

On September 1, 2006, Cordero Mining Company (CMC) filed an application with BLM to lease the federal coal included in a tract west and south of and immediately adjacent to the Cordero Rojo Mine in Campbell County, Wyoming, approximately 15 miles south-southeast of Gillette (figures ES-1 and ES-5). The tract, which is referred to as the Maysdorf II LBA tract, was assigned case number WYW173360. The federal coal reserves were applied for as a maintenance tract for the Cordero Rojo Mine, which is operated by CMC, a directly held subsidiary of Rio Tinto Energy America (formerly Kennecott Energy and Coal Company).

These lease applications were reviewed by BLM, Wyoming State Office, Division of Mineral and Lands Authorization, who determined that the applications and the lands involved met the requirements of the regulations governing coal leasing on application at 43 CFR 3425.1. The Powder River Regional Coal Team (PRRCT) reviewed the Belle Ayr North LBA tract at a public meeting held on April 24, 2005, in Gillette, Wyoming; the West Coal Creek and Caballo West LBA tracts were reviewed at a public meeting held on April 19, 2006, in Casper, Wyoming; and the Maysdorf II LBA tract was reviewed at a public meeting held on January 18, 2007, in Casper, Wyoming. The PRRCT recommended that BLM continue to process the Belle Ayr North, the West Coal Creek, the Caballo West, and the Maysdorf II coal lease applications at these respective meetings.

EVALUATION PROCESS

In order to process an LBA, BLM must evaluate the quantity, quality, maximum economic recovery, and fair market value of the federal coal and fulfill the requirements of the NEPA by evaluating the environmental consequences of leasing the federal coal.

To evaluate the environmental impacts of leasing the coal, BLM must prepare an environmental assessment (EA) or an EIS to evaluate the site-specific and cumulative environmental and socioeconomic impacts of leasing and developing the federal coal in an application area. Due to the proximity of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts, BLM made a decision to prepare a single EIS to evaluate the environmental impacts of coal mining that would result from the issuance of these four leases. BLM does not authorize mining by issuing a lease for federal coal, but the impacts of mining the coal are considered in this EIS because it is a logical consequence of issuing a maintenance lease to an existing mine.

The Environmental Protection Agency (EPA) published a notice announcing the availability of the draft EIS in the *Federal Register* on October 24, 2008. BLM published a Notice of Availability/Notice of Public Hearing in the *Federal Register* on October 17, 2008. The 60-day comment period on the draft EIS ended on December 24, 2008. A public hearing was held on November 19, in Gillette, Wyoming. One individual presented statements on the draft EIS during the hearing and written comments were received from 18 individuals, agencies, or organizations during the comment period. A summary of the statements

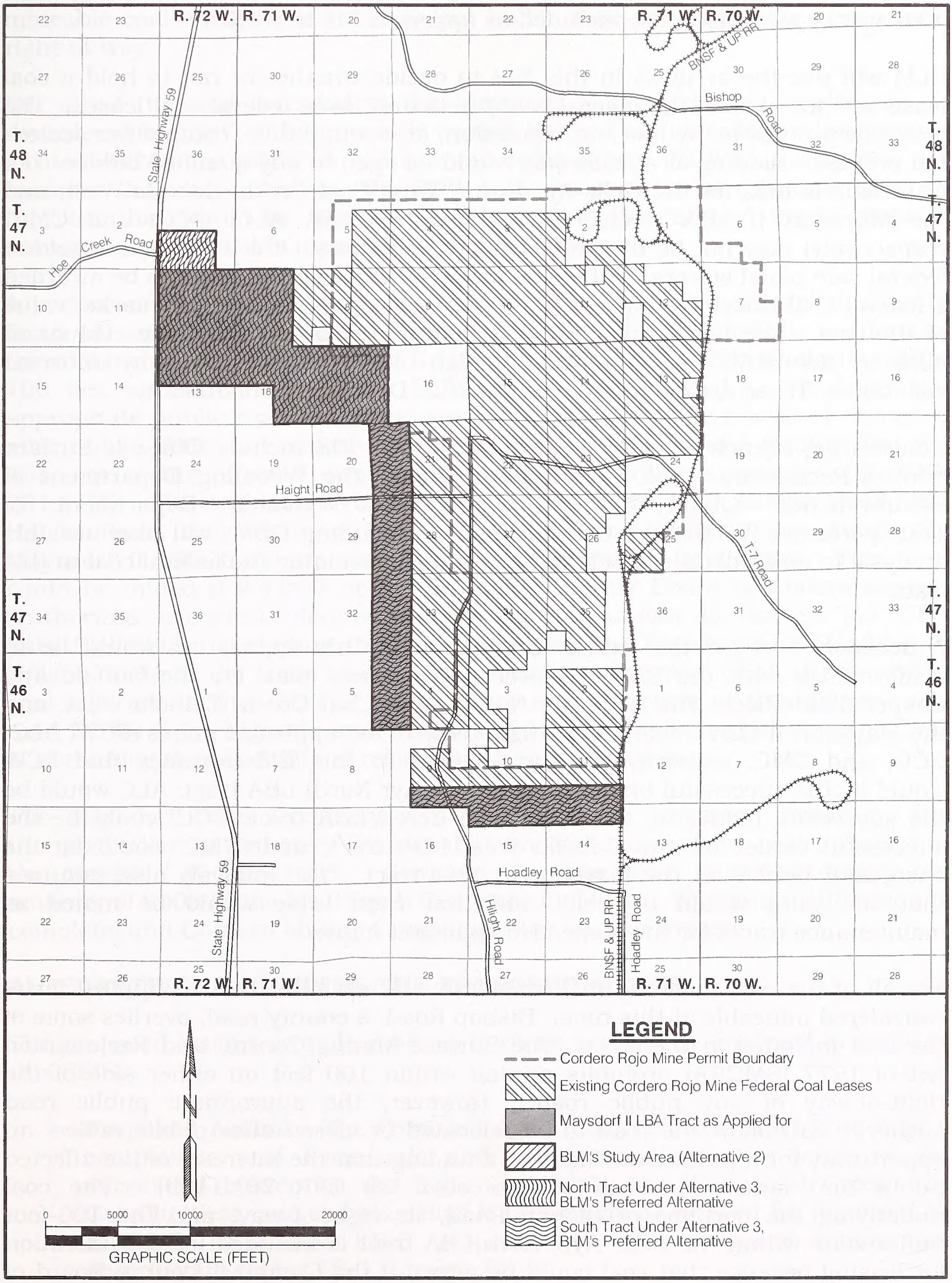


Figure ES-5. Maysdorf II LBA Tract Alternatives.

that were presented at the formal public hearing and the written comments, with agency responses, are included as appendix I of this FEIS.

BLM will use the analysis in this EIS to decide whether or not to hold a coal lease sale for each of the federal coal tracts and issue federal coal leases. The LBA sale process is, by law and regulation, an open, public, competitive sealed-bid process. Bidding at a lease sale would be open to any qualified bidder. If a lease sale is held for the Belle Ayr North, West Coal Creek, Caballo West, and the Maysdorf II LBA tracts, the applicants (FCW, ALC, CCC, and CMC, respectively) may not be the successful high bidders. If a lease sale is held, a federal sale panel selects the highest bidder at the sale. In order to be awarded a federal coal lease, the highest bid must meet or exceed the fair market value of the coal. The fair market value is determined by an economic evaluation done by the BLM. Additionally, the high bidder cannot have any antitrust violations. These are determined by the U.S. Department of Justice.

Cooperating agencies in the preparation of this EIS include Office of Surface Mining Reclamation and Enforcement (OSM), the Wyoming Department of Environmental Quality (WDEQ), and the Wyoming Department of Transportation (WYDOT)). Other agencies, including OSM, will also use this analysis to make decisions related to leasing and mining the federal coal in this tract.

A decision to lease the federal coal lands in this application would be in conformance with the BLM resource management plan for the Buffalo and Casper field offices. The Belle Ayr North, West Coal Creek, Caballo West, and the Maysdorf II LBA tracts are contiguous with the applicant mines (FCW, ALC, CCC, and CMC, respectively). The analysis in this EIS assumes that FCW would be the successful bidder on the Belle Ayr North LBA tract; ALC would be the successful bidder on the West Coal Creek LBA tract; CCC would be the successful bidder on the Caballo West LBA tract; and, CMC would be the successful bidder on the Maysdorf II LBA tract. The analysis also assumes that the sales would be held, and that each lease would be mined as maintenance tracts for the respective applicant mines.

Not all of the coal included in the Belle Ayr North LBA tract as applied for is considered mineable at this time. Bishop Road, a county road, overlies some of the coal included in the tract. The Surface Mining Control and Reclamation Act of 1977 (SMCRA) prohibits mining within 100 feet on either side of the right-of-way of any public road. However, the appropriate public road authority can allow the road to be relocated or closed after public notice, an opportunity for a public hearing, and a finding that the interests of the affected public and landowners will be protected [30 CFR 761.11(d)]. The coal underlying the portions of Bishop Road, its right-of-way, and the 100-foot buffer zone within the Belle Ayr North LBA tract is included for consideration for leasing because that coal could be mined if the Campbell County Board of Commissioners, the authorized agency, determines that the road can be moved [43 CFR 3461.5(c)(2)(iii)]. If the road is not moved, including the coal

underlying the road in the lease would allow maximum recovery of all the mineable coal adjacent to the 100-foot buffer zone on either side of the road right-of-way.

Not all of the coal included in the Maysdorf II LBA tract as applied for is considered by CMC to be mineable at this time. Coal included in the tract is located within the BNSF & UP railroad right-of-way (ROW). CMC does not consider the coal underlying the ROW to be recoverable at this time because the cost that would be associated with moving the railroad would make it economically unfeasible to recover the underlying coal.

A portion of Wyoming 59 and portions of the Haight Road (Campbell County Road 44) and the Hilight Road (Campbell County Road 52) overlie portions of the coal included in the Maysdorf II LBA tract. SMCRA prohibits mining within 100 feet on either side of the ROW of any public road. However, the appropriate public road authority can allow the road to be relocated or closed after public notice, an opportunity for a public hearing, and a finding that the interests of the affected public and landowners will be protected [30 CFR 761.11(d)]. The coal underlying the portion of Wyoming 59, Hilight Road, and Haight Road, their rights-of-way, and the 100-foot buffer zones within the Maysdorf II LBA tract are included for consideration for leasing. That coal could be mined if WYDOT or the Campbell County Board of Commissioners (authorized agencies), determine that the roads can be moved [43 CFR 3461.5(c)(2)(iii)]. Including the coal underlying the highway and Haight and Hilight roads in the lease would allow maximum recovery of all the mineable coal adjacent to the 100-foot buffer zones on either side of the highway and road ROWs if the highway and Haight and Hilight roads are not moved. CMC is evaluating the feasibility of relocating the county roads.

The Maysdorf Point Cemetery was a small rural cemetery owned by the Campbell County Cemetery District that overlaid some of the coal included in the Maysdorf II LBA tract. Cemetery remains were relocated during the summer of 2008 to the Mt. Pisgah Cemetery in Gillette, Wyoming. Mitigation is complete, and Cordero Mining Company is the surface owner.

ALTERNATIVES, INCLUDING THE PROPOSED ACTION

The proposed actions and alternatives to those actions are analyzed in detail in this FEIS.

- **Proposed Action** - The Proposed Action for each LBA tract is to hold a competitive coal lease sale and issue a maintenance lease to the successful bidder for the Belle Ayr North, the West Coal Creek, the Caballo West, and the Maysdorf II LBA tracts as applied for (figures ES-2, ES-3, ES-4, and ES-5, respectively). The proposed actions are described in tables ES-1 through ES-7.

Table ES-1. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for Belle Ayr North LBA tract and Belle Ayr Mine if the Bishop Road (Campbell County Road 12) is Moved and the Underlying Coal is Recovered.

Item	No Action Alternative (Existing Belle Ayr Mine)	Added by Proposed Action	Added by Alternative 2 (Preferred Alternative)
In-Place Coal (as of 6/30/08)	250.9 mmt	208.1 mmt	221.1 mmt
Mineable Coal (as of 6/30/08)	250.9 mmt	204.2 mmt	217.6 mmt
Recoverable Coal (as of 6/30/08)[1]	235.8 mmt	191.9 mmt	204.6 mmt
Coal Mined (as of 6/30/08)	544.5 mmt	—	—
Lease Area[2]	4,945.5 ac	1,578.7 ac	1,671.0 ac
Total Area To Be Disturbed[2]	11,621 ac	1,936.6 ac	1,947.0 ac
Permit Area[2]	11,935 ac	1,727 ac	1,818 ac
Current Air Quality Permitted Production	45.0 mmt	0 mmt	0 mmt
Average Annual Post-2007 Coal Production	30.0 mmt	0 mmt	0 mmt
Remaining Life of Mine (post-2007)	8.3 yrs	6.4 yr	6.8 yr
Average Number of Employees	358	8	8
Total Projected State Revenues (post-2007)[3]	$382.9 million	$342.2 – $410.7 million	$364.9 - $437.8 million
Total Projected Federal Revenues (post-2007)[4]	$283.6 million	$261.5 – $329.9 million	$278.7 - $351.6 million

1 Assumes 94 percent recovery of mineable coal.

2 The lease area includes federal coal leases only and does not include state and private coal within the permit boundary. The disturbed area exceeds the leased area (total federal, state and private) because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

3 Revenues to the state of Wyoming include severance taxes, property and production (ad valorum) taxes, sales and use taxes, and Wyoming's share of federal royalty payments, AML fees, and bonus bids. State revenues are based on $0.4312 per ton estimate for severance taxes × amount of recoverable coal, plus $0.372 per ton estimate for ad valorum taxes × amount of recoverable coal, plus $0.0569 per ton estimate for sales and use taxes × amount of recoverable coal, plus $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus federal's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus federal's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus federal's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution to states.

4 Federal revenues include black lung taxes and the federal government's share of federal royalty payments, AML fees, and bonus bids. Federal revenues are based on $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × black lung tax of 4.40 percent, plus $9.98 per ton (for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus state's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus state's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus state's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution to the federal government.

Table ES-2. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for Belle Ayr North LBA tract and Belle Ayr Mine if the Bishop Road (Campbell County Road 12) is Not Moved and the Underlying Coal is Not Recovered.

Item	No Action Alternative (Existing Belle Ayr Mine)	Added by Proposed Action	Added by Alternative 2 (Preferred Alternative)
In-Place Coal (as of 6/30/08)	250.9 mmt	208.1 mmt	221.1 mmt
Mineable Coal (as of 6/30/08)	250.9 mmt	164.7 mmt	159.6 mmt
Recoverable Coal (as of 6/30/08)[1]	235.8 mmt	154.8 mmt	150.1 mmt
Coal Mined (as of 6/30/08)	544.5 mmt	—	—
Lease Area[2]	4,945.5 ac	1,578.7 ac	1,671.0 ac
Total Area To Be Disturbed[2]	11,621 ac	1,274.9 ac	1,658.4 ac
Permit Area[2]	11,935 ac	1,727 ac	1,818 ac
Current Air Quality Permitted Production	45.0 mmt	0 mmt	0 mmt
Average Annual Post-2007 Coal Production	30.0 mmt	0 mmt	0 mmt
Remaining Life of Mine (post-2007)	8.3 yrs	5.2 yr	5.0 yr
Average Number of Employees	358	8	8
Total Projected State Revenues (post-2007)[3]	$382.9 million	$276.1 – $331.3 million	$267.7 - $321.1 million
Total Projected Federal Revenues (post-2007)[4]	$283.6 million	$210.9 – $266.1 million	$204.5 - $258.0 million

1 Assumes 94 percent recovery of mineable coal. This table excludes all coal that would not be mined beneath the Bishop County Road right-of-way.

2 The lease area includes federal coal leases only and does not include state and private coal within the permit boundary. The disturbed area exceeds the leased area (total federal, state and private) because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

3 Revenues to the state of Wyoming include severance taxes, property and production (ad valorum) taxes, sales and use taxes, and Wyoming's share of federal royalty payments, AML fees, and bonus bids. State revenues are based on $0.4312 per ton estimate for severance taxes × amount of recoverable coal, plus $0.372 per ton estimate for ad valorum taxes × amount of recoverable coal, plus $0.0569 per ton estimate for sales and use taxes × amount of recoverable coal, plus $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus federal's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus federal's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus federal's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution to states.

4 Federal revenues include black lung taxes and the federal government's share of federal royalty payments, AML fees, and bonus bids. Federal revenues are based on $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × black lung tax of 4.40 percent, plus $9.98 per ton (for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus state's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus state's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus state's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution to the federal government.

Table ES-3. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for West Coal Creek LBA tract and Coal Creek Mine.

Item	**No Action Alternative (Existing Coal Creek Mine)**	**Added by Proposed Action**	**Added by Alternative 2 (Preferred Alternative)**
In-Place Coal (as of 6/30/08)	241.7 mmt	63.3 mmt	69.3 mmt
Mineable Coal (as of 6/30/08)	241.7 mmt	63.3 mmt	63.3 mmt
Recoverable Coal (as of 6/30/08)[1]	217.5 mmt	57.0 mmt	57.0 mmt
Coal Mined (as of 6/30/08)	68.9 mmt	—	—
Lease Area[2]	5,918.0 ac	1,151.3 ac	1,232.2 ac
Total Area To Be Disturbed[2]	8,354.9 ac	1,925.4 ac	2,210.1 ac
Permit Area[2]	9,722.7 ac	3,162 ac	3,162 ac
Current Air Quality Permitted Production	25.0 mmt	0 mmt	0 mmt
Average Annual Post-2007 Coal Production	13.4 mmt	0 mmt	0 mmt
Remaining Life of Mine (post-2007)	16.2 yrs	4.3 yr	4.3 yr
Average Number of Employees	125	0	0
Total Projected State Revenues (post-2007)[3]	$353.2 million	$102.1 – $123.3 million	$102.1 - $123.3 million
Total Projected Federal Revenues (post-2007)[4]	$261.6 million	$78.1 - $99.3 million	$78.1 - $99.3 million

1 Assumes 90 percent recovery of mineable coal.

2 The lease area includes federal coal leases only and does not include state and private coal within the permit boundary. The disturbed area exceeds the leased area (total federal, state and private) because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

3 Revenues to the state of Wyoming include severance taxes, property and production (ad valorum) taxes, sales and use taxes, and Wyoming's share of federal royalty payments, AML fees, and bonus bids. State revenues are based on $0.4312 per ton estimate for severance taxes × amount of recoverable coal, plus $0.372 per ton estimate for ad valorum taxes × amount of recoverable coal, plus $0.0569 per ton estimate for sales and use taxes × amount of recoverable coal, plus $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus federal's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus federal's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus federal's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to states.

4 Federal revenues include black lung taxes and the federal government's share of federal royalty payments, AML fees, and bonus bids. Federal revenues are based on $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × black lung tax of 4.40 percent, plus $9.98 per ton (for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus state's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus state's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus state's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to the federal government.

Table ES-4. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for Caballo West LBA tract and Caballo Mine if the Bishop Road (Campbell County Road 12) is Moved and the Underlying Coal is Recovered.

Item	No Action Alternative (Existing Caballo Mine)	Added by Proposed Action	Added by Alternative 2 (Preferred Alternative)
In-Place Coal (as of 6/30/08)	893.7 mmt	98.2 mmt	131.4 mmt
Mineable Coal (as of 6/30/08)	687.8 mmt	87.5 mmt	105.5 mmt
Recoverable Coal (as of 6/30/08)[1]	584.8 mmt	81.8 mmt	98.6 mmt
Coal Mined (as of 6/30/08)	510.4 mmt	—	—
Lease Area[2]	11,704.5 ac	777.5 ac	1,024.0 ac
Total Area To Be Disturbed[2]	16,898.0 ac	1,349.9 ac	1,390.4 ac
Permit Area[2]	19,974.7 ac	1,294.1 ac	1,518.4 ac
Current Air Quality Permitted Production	50.0 mmt	0 mmt	0 mmt
Average Annual Post-2007 Coal Production	37.8 mmt	0 mmt	0 mmt
Remaining Life of Mine (post-2007)	15.4 yrs	2.2 yr	2.6 yr
Average Number of Employees	549	0	0
Total Projected State Revenues (post-2007)[3]	$949.6 million	$146.0 – $175.3 million	$175.9 - $211.3 million
Total Projected Federal Revenues (post-2007)[4]	$703.4 million	$111.5 - $140.8 million	$134.4 - $169.8 million

1 Assumes 93.5 percent recovery of mineable coal.

2 The lease area includes federal coal leases only and does not include state and private coal within the permit boundary. The disturbed area exceeds the leased area (total federal, state and private) because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

3 Revenues to the state of Wyoming include severance taxes, property and production (ad valorum) taxes, sales and use taxes, and Wyoming's share of federal royalty payments, AML fees, and bonus bids. State revenues are based on $0.4312 per ton estimate for severance taxes × amount of recoverable coal, plus $0.372 per ton estimate for ad valorum taxes × amount of recoverable coal, plus $0.0569 per ton estimate for sales and use taxes × amount of recoverable coal, plus $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus federal's 50 percent share, plus $0.28per ton for AML fees × amount of recoverable coal minus federal's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus federal's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to states.

4 Federal revenues include black lung taxes and the federal government's share of federal royalty payments, AML fees, and bonus bids. Federal revenues are based on $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × black lung tax of 4.40 percent, plus $9.98 per ton (for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus state's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus state's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus state's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to the federal government.

Table ES-5. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for Caballo West LBA tract and Caballo Mine if the Bishop Road (Campbell County Road 12) is Not Moved and the Underlying Coal is Not Recovered.

Item	No Action Alternative (Existing Caballo Mine)	Added by Proposed Action	Added by Alternative 2 (Preferred Alternative)
In-Place Coal (as of 6/30/08)	893.7 mmt	98.2 mmt	131.4 mmt
Mineable Coal (as of 6/30/08)	687.8 mmt	87.5 mmt	98.1 mmt
Recoverable Coal (as of 6/30/08)[1]	584.8 mmt	81.8 mmt	91.7 mmt
Coal Mined (as of 6/30/08)	510.4 mmt	—	—
Lease Area[2]	11,704.5 ac	777.5 ac	1,024.0 ac
Total Area To Be Disturbed[2]	16,898.0 ac	1,213.0 ac	1,253.6 ac
Permit Area[2]	19,974.7 ac	1,294.1 ac	1,518.4 ac
Current Air Quality Permitted Production	50.0 mmt	0 mmt	0 mmt
Average Annual Post-2007 Coal Production	37.8 mmt	0 mmt	0 mmt
Remaining Life of Mine (post-2007)	15.4 yrs	2.2 yr	2.4 yr
Average Number of Employees	549	0	0
Total Projected State Revenues (post-2007)[3]	$949.6 million	$146.0 – $175.3 million	$163.6 - $196.5 million
Total Projected Federal Revenues (post-2007)[4]	$703.4 million	$111.5 - $140.8 million	$125.0 - $157.9 million

1 Assumes 93.5 percent recovery of mineable coal. This table excludes all coal that would not be mined beneath the Bishop County Road right-of-way.

2 The lease area includes federal coal leases only and does not include state and private coal within the permit boundary. The disturbed area exceeds the leased area (total federal, state and private) because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

3 Revenues to the state of Wyoming include severance taxes, property and production (ad valorum) taxes, sales and use taxes, and Wyoming's share of federal royalty payments, AML fees, and bonus bids. State revenues are based on $0.4312 per ton estimate for severance taxes × amount of recoverable coal, plus $0.372 per ton estimate for ad valorum taxes × amount of recoverable coal, plus $0.0569 per ton estimate for sales and use taxes × amount of recoverable coal, plus $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus federal's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus federal's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus federal's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to states.

4 Federal revenues include black lung taxes and the federal government's share of federal royalty payments, AML fees, and bonus bids. Federal revenues are based on $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × black lung tax of 4.40 percent, plus $9.98 per ton (for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus state's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus state's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus state's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to the federal government.

Table ES-6. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for Maysdorf II LBA tract, Assuming Wyoming Highway 59 and the BNSF & UP Railroad are Not Moved and the Underlying Coal is Not Recovered and if the Haight and Hilight Roads are Moved and the Underlying Coal is Recovered.

Item	No Action Alternative (Existing Cordero Rojo Mine)	Added by Proposed Action	Added by Alternative 2	Added by Alternative 3 (Preferred Alternative)	
				(North Tract)	(South Tract)
In-Place Coal (as of 6/30/08)	572.9 mmt	504.2 mmt	533.2 mmt	326.4 mmt	206.8 mmt
Mineable Coal (as of 6/30/08)	571.5 mmt	499.7 mmt	527.5 mmt	322.5 mmt	205.0 mmt
Recoverable Coal (as of 6/30/08)[1]	525.9 mmt	449.8 mmt	474.7 mmt	290.2 mmt	184.5 mmt
Coal Mined (as of 6/30/08)	769.3 mmt	—	—	—	—
Lease Area[2]	13,529.31 ac	4,653.8 ac	4,895.6 ac	2,825.4 ac	2,070.3 ac
Total Area To Be Disturbed[2]	14,694.0 ac	6,675.0 ac	6,917.3 ac	3,429.6 ac	3,487.7 ac
Permit Area[2]	16,910.6 ac	16,832.4 ac	16,832.4 ac	6,850.3 ac	10,683.4 ac
Current Air Quality Permitted Production	65.0 mmt	0 mmt	0 mmt	0 mmt	0 mmt
Average Annual Post-2007 Coal Production	46.3 mmt	0 mmt	0 mmt	0 mmt	0 mmt
Remaining Life of Mine (post-2007)	11.4 yrs	9.7 yr	10.3 yr	6.3 yr	4.0 yr
Average Number of Employees	510	60	63	8	2
Total Projected State Revenues (post-2007)[3]	$854.0 million	$805.4 – $972.7 million	$850.1 - $1026.9 million	$519.6 - $627.7 million	$330.4 – $399.0 million
Total Projected Federal Revenues (post-2007)[4]	$632.6 million	$616.0 - $783.4 million	$650.2 - $827.0 million	$397.4 - $505.5 million	$252.7 - $321.3 million

1 Assumes 90 percent recovery of mineable coal. This table excludes all coal that would not be mined beneath the Wyoming Highway 59 right-of-way and the BNSF & UP railroad right-of-way.

2 The lease area includes federal coal leases only and does not include state and private coal within the permit boundary. The disturbed area exceeds the leased area (total federal, state and private) because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

3 Revenues to the state of Wyoming include severance taxes, property and production (ad valorum) taxes, sales and use taxes, and Wyoming's share of federal royalty payments, AML fees, and bonus bids. State revenues are based on $0.4312 per ton estimate for severance taxes × amount of recoverable coal, plus $0.372 per ton estimate for ad valorum taxes × amount of recoverable coal, plus $0.0569 per ton estimate for sales and use taxes × amount of recoverable coal, plus $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus federal's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus federal's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus federal's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to states.

4 Federal revenues include black lung taxes and the federal government's share of federal royalty payments, AML fees, and bonus bids. Federal revenues are based on $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × black lung tax of 4.40 percent, plus $9.98 per ton (for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus state's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus state's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus state's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to the federal government.

Table ES-7. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for Maysdorf II LBA tract, Assuming Wyoming Highway 59, the Haight and Hilight Roads, and the BNSF & UP Railroad are Not Moved and the Underlying Coal is Not Recovered.

Item	No Action Alternative (Existing Cordero Rojo Mine)	Added by Proposed Action	Added by Alternative 2	Added by Alternative 3 (Preferred Alternative)	
				(North Tract)	(South Tract)
In-Place Coal (as of 6/30/08)	572.9 mmt	504.2 mmt	533.2 mmt	326.4 mmt	206.8 mmt
Mineable Coal (as of 6/30/08)	571.5 mmt	482.7 mmt	510.5 mmt	322.5 mmt	188.0 mmt
Recoverable Coal (as of 6/30/08)[1]	525.9 mmt	434.5 mmt	459.5 mmt	290.2 mmt	169.3 mmt
Coal Mined (as of 6/30/08)	769.3 mmt	—	—	—	—
Lease Area[2]	13,529.31 ac	4,653.8 ac	4,895.6 ac	2,825.4 ac	2,070.3 ac
Total Area To Be Disturbed[2]	14,694.0 ac	6,200.8 ac	6,422.5 ac	3,353.9 ac	3,068.6 ac
Permit Area[2]	16,910.6 ac	16,832.4 ac	16,832.4 ac	6,850.3 ac	10,683.4 ac
Current Air Quality Permitted Production	65.0 mmt	0 mmt	0 mmt	0 mmt	0 mmt
Average Annual Post-2007 Coal Production	46.3 mmt	0 mmt	0 mmt	0 mmt	0 mmt
Remaining Life of Mine (post-2007)	11.4 yrs	9.4 yr	9.9 yr	6.3 yr	3.7 yr
Average Number of Employees	510	60	63	8	2
Total Projected State Revenues (post-2007)[3]	$854.0 million	$778.0 – $939.7 million	$822.8 - $993.7 million	$519.6 - $627.7 million	$303.2 – $366.1 million
Total Projected Federal Revenues (post-2007)[4]	$632.6 million	$595.1 - $756.7 million	$629.3 - $800.3 million	$397.4 - $505.5 million	$231.9 - $294.8 million

[1] Assumes 90 percent recovery of mineable coal. This table excludes all coal that would not be mined beneath the Wyoming Highway 59 right-of-way, BNSF & UP railroad right-of-way, and the Haight and Hilight Roads rights-of-way.

[2] The lease area includes federal coal leases only and does not include state and private coal within the permit boundary. The disturbed area exceeds the leased area (total federal, state and private) because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

[3] Revenues to the state of Wyoming include severance taxes, property and production (ad valorum) taxes, sales and use taxes, and Wyoming's share of federal royalty payments, AML fees, and bonus bids. State revenues are based on $0.4312 per ton estimate for severance taxes × amount of recoverable coal, plus $0.372 per ton estimate for ad valorum taxes × amount of recoverable coal, plus $0.0569 per ton estimate for sales and use taxes × amount of recoverable coal, plus $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus federal's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus federal's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus federal's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to states.

[4] Federal revenues include black lung taxes and the federal government's share of federal royalty payments, AML fees, and bonus bids. Federal revenues are based on $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × black lung tax of 4.40 percent, plus $9.98 per ton (for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus state's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus state's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus state's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to the federal government.

- **Alternative 1** - Under Alternative 1, the No Action alternative for each tract, the LBA tracts would not be leased, but the existing leases at the adjacent Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines would be developed according to the existing approved mining plans. The No Action alternatives are described in tables ES-1 through ES-7. Rejection of the lease applications would not preclude an application to lease the tracts in the future.

- **Alternative 2** - Under Alternative 2 for each tract, BLM would reconfigure the tract to include some or the entire LBA tract as applied for and may increase the size of the tract. BLM would hold a competitive lease sale and issue a maintenance lease for a tract that is larger than the applied-for tract. Alternative 2 is the Preferred Alternative for the Belle North, West Coal Creek, and Caballo West LBA tracts. Alternative 2 for each LBA tract is shown on figures ES-2 through ES-5 and described in tables ES-1 through ES-7.

- **Alternative 3** - Under Alternative 3 (for the Maysdorf II LBA tract only), BLM would divide the tract into two tracts and offer one or both of those tracts for sale. A separate, competitive sealed bid sale would be held for each tract that is offered for sale. Alternative 3 is the Preferred Alternative for the Maysdorf II LBA tract. Alternative 3 is shown on figures ES-4 and ES-5 and described in tables ES-6 and ES-7.

BLM identified a study area for each LBA tract in order to evaluate the potential that an alternate configuration of the tract would provide more efficient recovery of the federal coal, increase competitive interest in the tract, and/or reduce the potential that some of the remaining unleased federal coal in this area would be bypassed in the future. The BLM study area includes the tract as applied for plus adjacent unleased federal coal, which is depicted as the additional area evaluated under Alternatives 2 and 3 in figures ES-2 through ES-7.

One alternative that was considered but not analyzed in detail included holding competitive coal lease sales and issuing leases for one or more of the tracts to the successful bidder (not the applicants) for the purpose of developing new stand-alone mines. Another alternative called for delaying the sale of one or more of the tracts as applied for to increase the benefit to the public afforded by higher coal prices or to allow more complete recovery of the potential coal bed natural gas (CBNG) resources in the tracts prior to mining.

Tables ES-2, ES-5, and ES-7 summarize estimated coal production, surface disturbance, and mine life for the Belle Ayr, Caballo, and Cordero Rojo mines if the public highway/county roads are not moved. The environmental impacts of mining the LBA tracts would be similar under the Proposed Action and action alternatives. The following discussion assumes that the county roads are not moved.

ENVIRONMENTAL CONCERNS

Critical elements of the human environment that could be affected by the proposed project include air quality, cultural resources, Native American religious concerns, threatened and endangered (T&E) plant and animal species, migratory birds, hazardous or solid waste, water quality, wetlands/riparian zones, floodplains, environmental justice, and invasive nonnative species (BLM 1988). Four other critical elements (areas of critical environmental concern, prime and unique farmland, wild and scenic rivers, and wilderness) are not present in the project areas and are not addressed further. In addition to the critical elements that are potentially present in the project areas, the EIS discusses the status and potential effects of the project on topography and physiography, geology, mineral resources, soils, water availability and quality, alluvial valley floors (AVFs), vegetation, wildlife, land use and recreation, paleontological resources, visual resources, noise, transportation resources, and socioeconomics.

Topography

The general South Gillette analysis area (the general area around all four LBA tracts) is located in the PRB, a part of the Northern Great Plains that includes most of northeastern Wyoming. The Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts are located in the eastern part of the PRB, in an area consisting primarily of a dissected rolling upland plain with low relief, broken by low red-capped buttes, mesas, hills, and ridges. Playas are common in the basin, as are buttes and plateaus capped by clinker or sandstone. Elevations in the general South Gillette analysis area range from about 4,515 feet to 4,885 feet above sea level and slopes range from flat to around 57 percent. In the individual tracts, the average slopes range from 4 to 5 percent.

The existing topography on each LBA tract that is leased would be substantially changed during mining. A highwall with a vertical height equal to overburden plus coal thickness would exist in the active pits. Following reclamation, the average surface elevation would be lower due to removal of the coal. The reclaimed land surface would approximate premining contours, and the basic drainage network would be retained; however, the reclaimed surface would typically contain fewer and gentler topographic features. This could contribute to reduced habitat diversity and wildlife carrying capacity on the LBA tracts. These topographic changes would not conflict with regional land use, and the postmining topography would adequately support anticipated postmining land use for each tract.

Geology and Coal Resources

The mineable coal seams in the PRB are part of the Tongue River Member of the Fort Union. These are referred to as the Anderson and Canyon, Wyodak-Anderson, and Wyodak coal beds by mines in the eastern PRB. There is one mineable coal zone within the general South Gillette analysis area. Locally,

this coal zone is referred to as either the Wyodak or the Wyodak-Anderson. The average thickness of the Wyodak coal seam ranges between 36 feet within the West Coal Creek LBA tract to 74 feet within the Caballo West LBA. Up to five noncoal splits or partings occur within the seam, but they are typically local, discontinuous lenses of carbonaceous clay or shale that are less than 1 foot thick.

The geology from the base of the coal to the land surface would be subject to considerable permanent change on each LBA tract under all alternatives. The coal would be permanently removed. The replaced overburden would be a relatively homogeneous mixture compared to the premining layered overburden.

Other Minerals

Development of other minerals potentially present on the tracts could not occur during mining but could occur after mining. According to the January 2008 reserve estimate of conventional oil and gas resources that was prepared by Allen & Crouch Petroleum Engineers, Inc. of Casper, Wyoming, there are currently 18 wells capable of producing oil or conventional gas located on the four LBA tract study areas. Of the 18 wells, 13 are considered to have recoverable reserves, using in-place oil and gas recovery methods. Estimated remaining recoverable reserves from these 13 wells are just over 273,700 barrels of oil and 12 million cubic feet (mmcf) of gas. Any oil and conventional wells on the tracts would have to be plugged and abandoned during mining but could be recompleted after mining if the remaining reserves justify the expense of the recompletion.

Wyoming Oil and Gas Conservation Commission (WOGCC) records show that as of December 13, 2007, 445 wells had been drilled for CBNG production in the 57-section area encompassing or immediately adjacent to the general South Gillette analysis area and 288 were capable of producing (WOGCC 2007). There are 153 CBNG wells within the four LBA tracts. CBNG is also being produced locally from other deeper seams in the PRB. Fifteen wells have been completed in the deeper Pawnee coal seam on and west of the Maysdorf II LBA tract. All of these Pawnee wells are either shut in or are producing water (WOGCC 2007). CBNG resources that are not recovered prior to mining would be vented to the atmosphere and irretrievably lost when the coal is removed. BLM's policy is to optimize recovery of both resources, ensure the public receives a reasonable return, and encourage agreements between lessees or use BLM authority to minimize loss of publicly owned resources.

Paleontology Resources

Significant or unique paleontological resources have not been reported by the SGAC mines, although additional surveys for paleontological resources may be required.

Air Quality

Surface coal mining activities generate fugitive dust and particulate and gaseous tailpipe emissions from large mining equipment. Specifically, activities such as blasting, excavating, loading and hauling of overburden and coal, and wind erosion of disturbed and unreclaimed mining areas produce fugitive dust. Coal crushing, storage, and handling facilities are the most common stationary or point sources associated with surface coal mining and preparation. Particulate matter is the pollutant emitted from coal mine point sources. Since 1989, the regulated particulate pollutant in Wyoming has been PM_{10} (particulate matter with an aerodynamic diameter of 10 microns or less). Wyoming also adopted a fine particulate, $PM_{2.5}$ (particulate matter with a mean aerodynamic diameter of 2.5 microns or less), standard in March 2000. EPA has revoked the annual PM_{10} standard of 50 $\mu g/m^3$ but retained the 24-hour PM_{10} standard of 150 $\mu g/m^3$. Until the state of Wyoming enters into rulemaking to revise the WAAQS, the annual PM_{10} standard of 50 $\mu g/m^3$ is still effective.

Blasting is also responsible for another type of emission from surface coal mining. Overburden and coal blasting sometimes produces gaseous, orange-colored clouds that contain nitrous dioxide (NO_2). Exposure to NO_2 may have adverse health effects. NO_2 is one of several products resulting from the incomplete combustion of explosives used in the blasting process.

Other existing air pollutant emission sources within the region include:

- CO and nitrogen oxides (NO_x) from internal combustion engines used at natural gas and CBNG pipeline compressor stations;
- CO, NO_x, particulates (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), and volatile organic compounds (VOCs) from gasoline and diesel vehicle tailpipe emissions;
- Particulate matter (dust) generated by vehicle travel on unpaved graded roads, agricultural activities such as plowing, and paved road sanding during the winter months, as well as windblown dust from neighboring areas;
- NO_2 and PM_{10} emissions from railroad locomotives used to haul coal;
- SO_2 and NO_x from power plants. The closest coal-fired power plants are the Dave Johnston plant, located about 40-60 miles south-southwest of these six LBA tracts, and the Wyodak, Wygen, and Neil Simpson plants, located about 35-55 miles north of these four LBA tracts; and
- Air pollutants transported from emission sources located outside the PRB.

Moderately adverse short-term impacts to air quality would be extended onto the Belle Ayr North LBA tract. Long-term modeling predicted no exceedances of the annual PM_{10} National Ambient Air Quality Standards (NAAQS) at the permitted 45-mmtpy production rate. There have been no exceedances of the 24-hour and annual PM_{10} NAAQS at the Belle Ayr Mine. The dispersion model

showed a maximum PM_{10} concentration on the boundary of the Belle Ayr lands necessary to conduct mining (LNCM) of 42.02 micrograms per cubic meter (μg/m³) in 2013 (figure ES-6).

Moderately adverse short-term impacts to air quality would be extended onto the West Coal Creek LBA tract. Long-term modeling predicted no exceedances of the annual PM_{10} NAAQS at the permitted 50-mmtpy production rate. There have been no exceedances of the 24-hour and annual PM_{10} NAAQS at the Coal Creek Mine. The dispersion model showed a maximum PM_{10} concentration on the Coal Creek LNCM boundary of 38.88 μg/m³ in 2016 (figure ES-7).

Moderately adverse short-term impacts to air quality would be extended onto the Caballo West LBA tract. Long-term modeling predicted no exceedances of the annual PM_{10} NAAQS at the permitted 50-mmtpy production rate and there have been no exceedances of the 24-hour and annual PM_{10} NAAQS. The dispersion model showed a maximum PM_{10} concentration on the Caballo LNCM boundary of 46.98 μg/m³ in 2014 (figure ES-8).

Moderately adverse short-term impacts to air quality would be extended onto the Maysdorf II LBA tract. Long-term modeling predicted no exceedances of the annual PM_{10} NAAQS at the permitted 65-mmtpy production rate. There have been no exceedances of the 24-hour and annual PM_{10} NAAQS. The dispersion model showed a maximum PM_{10} concentration on the Cordero Rojo LNCM boundary of 45.6 μg/m³ in 2007 (figure ES-9).

There would be an increase in stripping ratio in each of the LBA tracts compared to the applicant mines' current leases. That could result in an increase in fugitive emissions per ton of coal mined from current levels due to the increased volume of overburden that would have to be removed to recover the coal. The increase in fugitive dust emissions could potentially be moderated somewhat if removal of the larger volume of overburden material results in a slower rate of mining advancement through the LBA tracts. This would potentially decrease the number of acres disturbed annually and cause haul distances to increase more slowly. Particulate emissions are expected to remain within daily and annual limits.

Low-lying, gaseous orange clouds containing nitrogen oxides (NO_X) that can be transported by wind can sometimes form from overburden blasting prior to coal removal. EPA has expressed concerns that NO_X levels in some blasting clouds may be sufficiently high at times to cause human health effects. Because of these incidents, Wyoming Department of Environment Quality/Land Quality Division (WDEQ/LQD) has directed some mines to take steps designed to mitigate the effects of NO_2 emissions occurring from overburden blasting. To date, there have been no reported events of public exposure to NO_2 from blasting activities at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines. There were two reports of off-site NO_X clouds related to cast blasts at the Caballo Mine prior to September 2007 but no actual exposure complaints

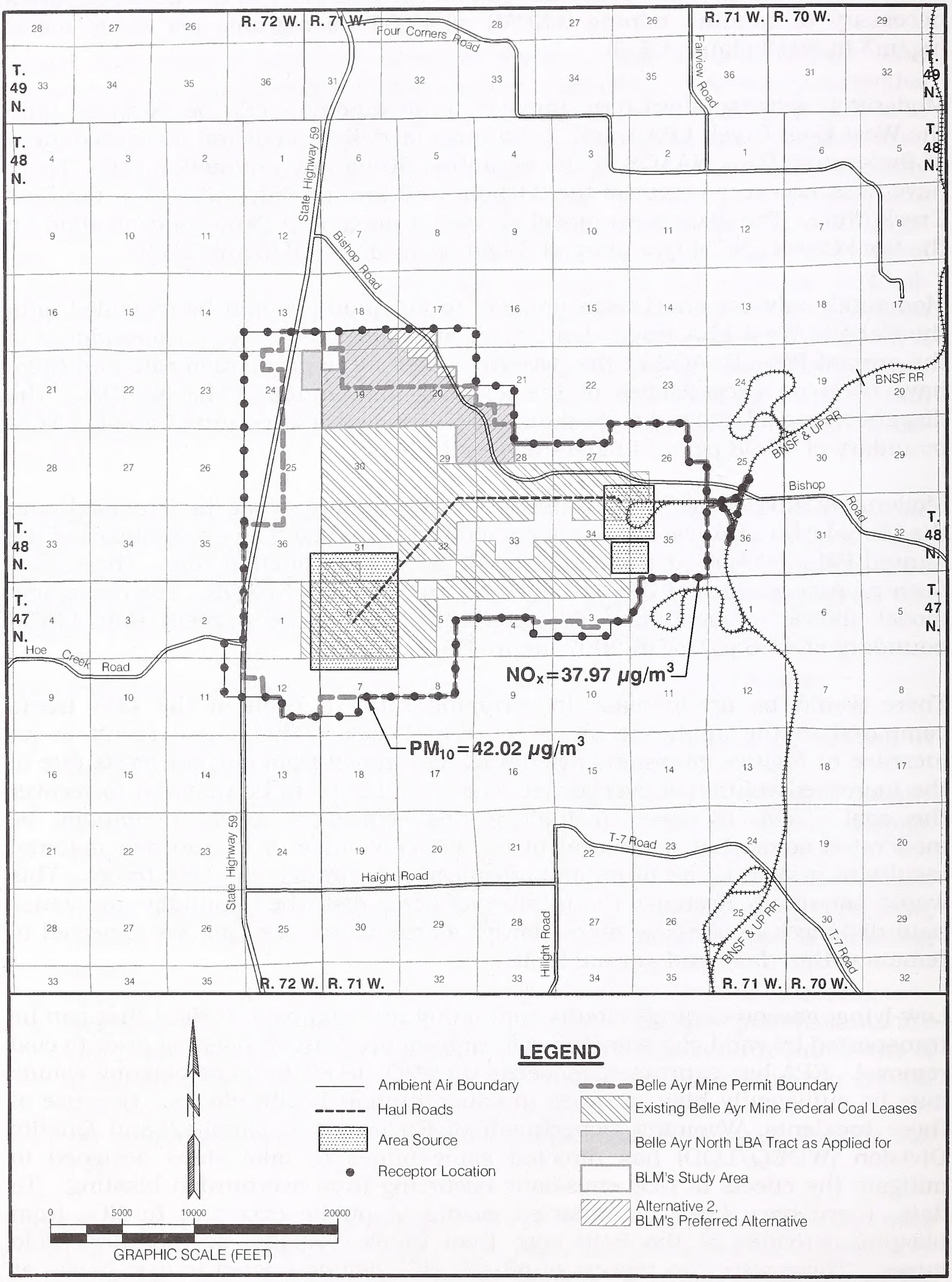


Figure ES-6. Maximum Modeled PM_{10} and NO_X Concentrations at the Belle Ayr Mine Ambient Air Boundary for the Year 2013.

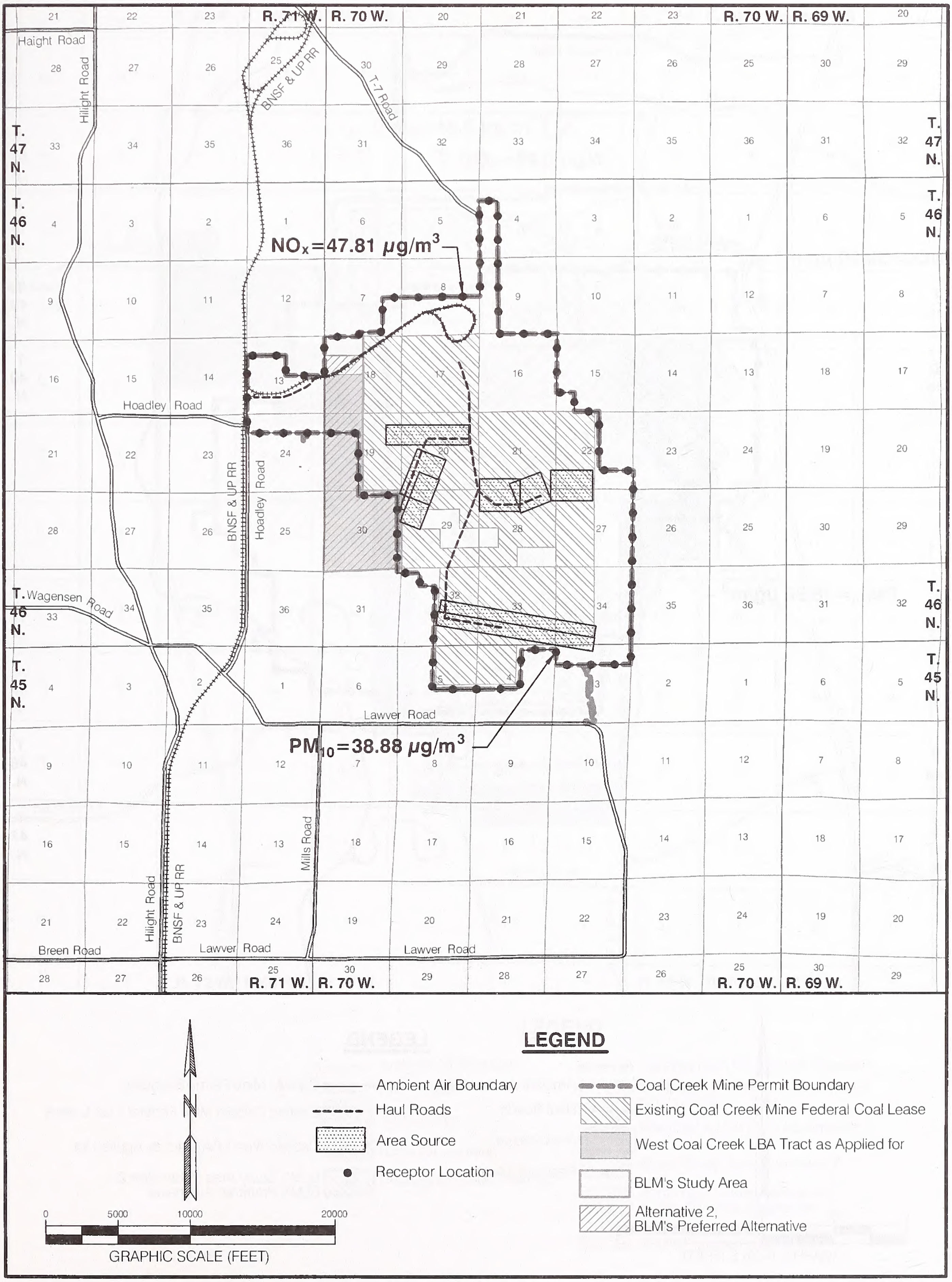


Figure ES-7. Maximum Modeled PM_{10} and NO_X Concentrations at the Coal Creek Mine Ambient Air Boundary for the Year 2016.

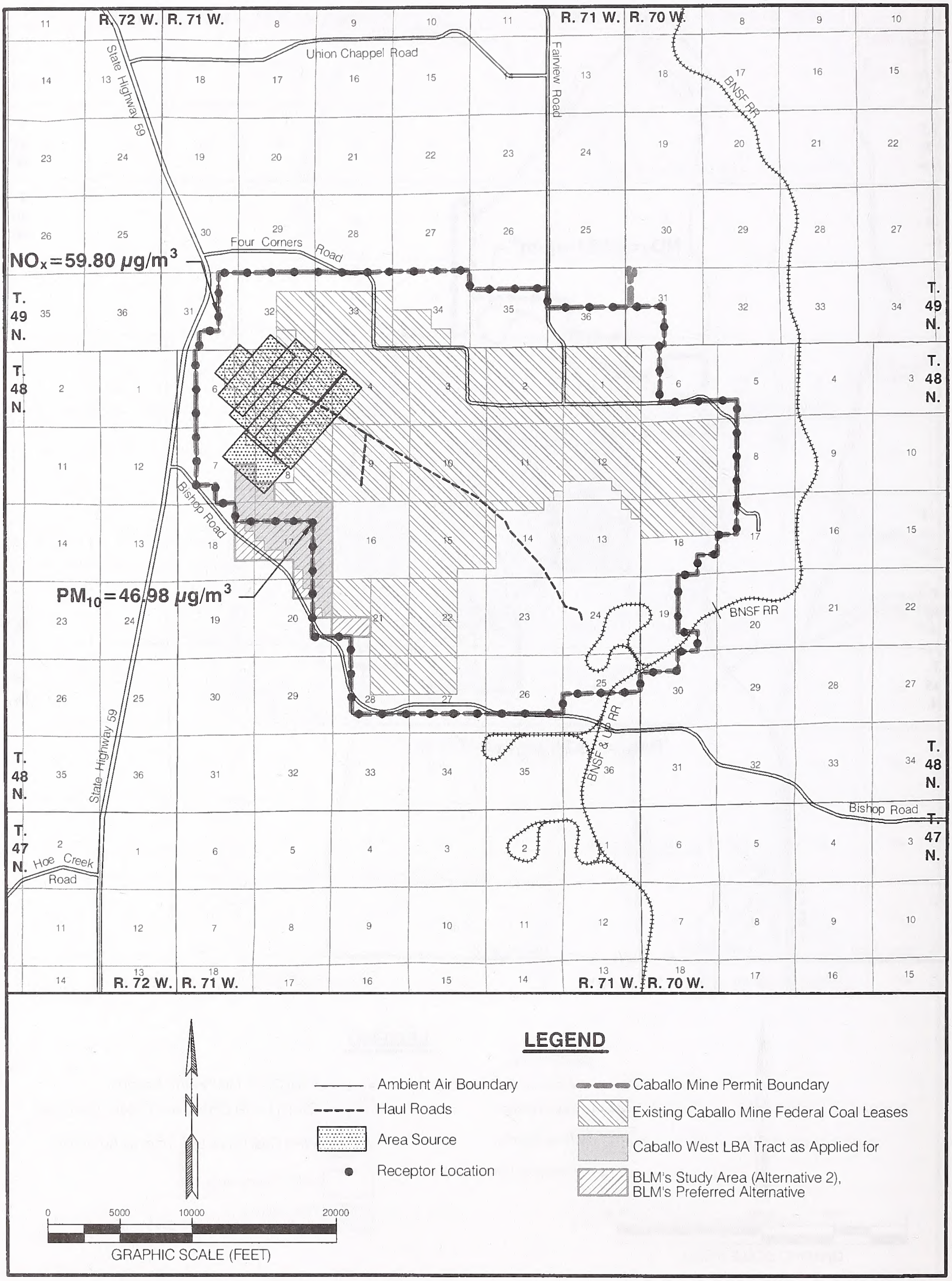


Figure ES-8. Maximum Modeled PM_{10} and NO_x Concentrations at the Caballo Mine Ambient Air Boundary for the Year 2014.

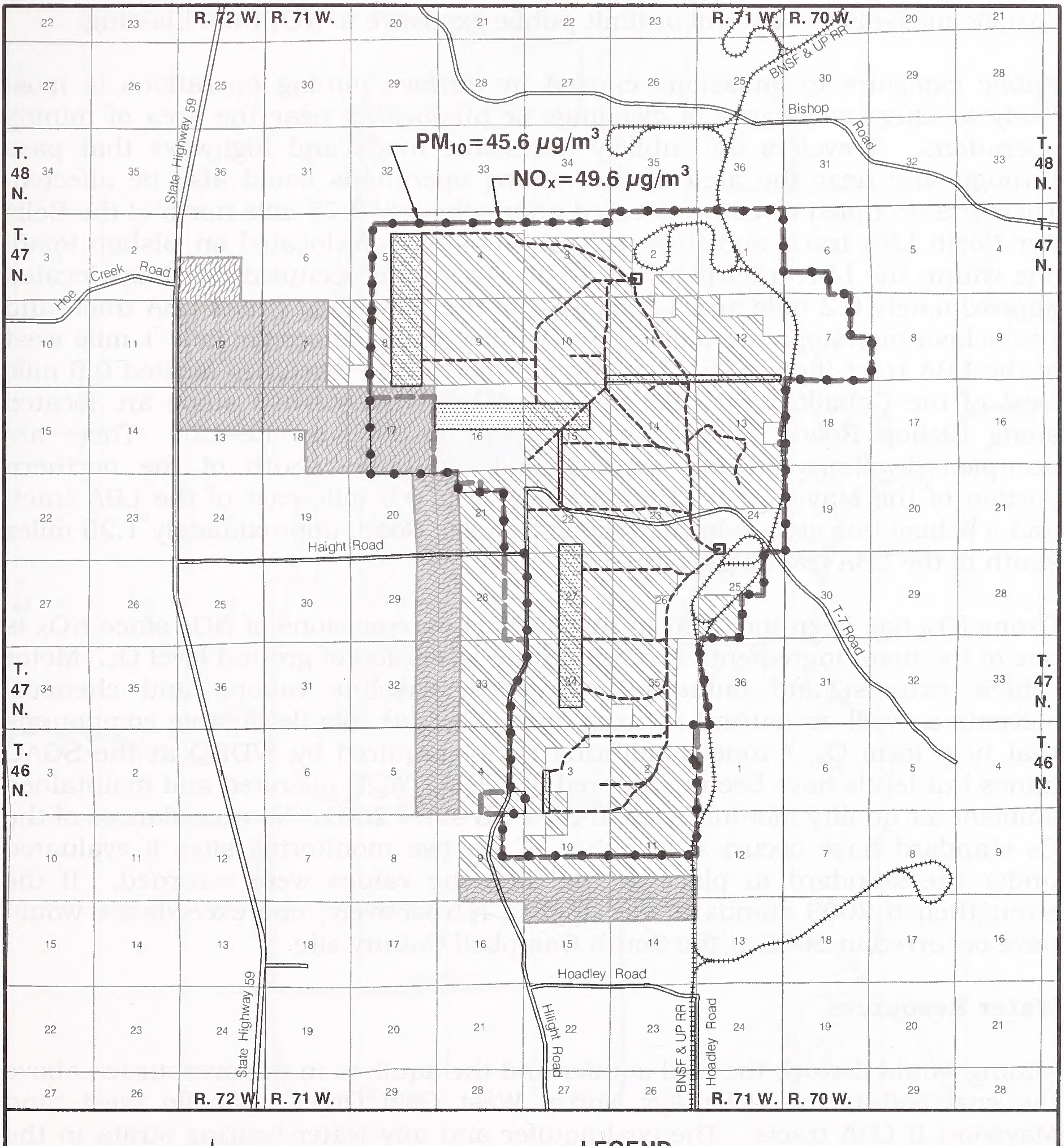


Figure ES-9. Maximum Modeled PM$_{10}$ and NO$_x$ Concentrations at the Cordero Rojo Mine Ambient Air Boundary for the Year 2007.

were reported. The WDEQ has not required the mines to implement any specific measures to control or limit public exposure to NO_2 from blasting.

Public exposure to emissions caused by surface mining operations is most likely to affect occupants of dwellings or businesses near the area of mining operations. Travelers on publicly accessible roads and highways that pass through and near the area of the mining operations could also be affected. There are occupied dwellings located approximately 0.75 mile north of the Belle Ayr North LBA tract, and three school bus stops are located on Bishop Road, one within the LBA tract (figure ES-10). There are occupied dwellings located approximately 0.2 mile and 1 mile west of the West Coal Creek LBA tract, and two school bus stops are located on Hoadley Road, approximately 1 mile west of the LBA tract (figure ES-11). There are occupied dwellings located 0.6 mile west of the Caballo West LBA tract, and three school bus stops are located along Bishop Road, adjacent to the LBA tract (figure ES-12). There are occupied dwellings located approximately 0.4 mile south of the northern portion of the Maysdorf II LBA tract and over 0.5 mile east of the LBA tract, and a school bus stop is located along Hoadley Road, approximately 1.25 miles south of the LBA tract (figure ES-13).

Ozone (O_3) has been included in discussions on emissions of NO_X since NO_X is one of the main ingredients involved in the formation of ground level O_3. Motor vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents as well as natural sources emit NO_X and volatile organic compounds that help form O_3. Ozone monitoring is not required by WDEQ at the SGAC mines but levels have been monitored at WDEQ/AQD operated and maintained ambient air quality monitor sites in the PRB since 2001. No exceedances of the O_3 standard have occurred at either of the two monitoring sites if evaluated under the standard in place at the time the values were recorded. If the strengthened 2008 standard was applied retroactively, one exceedance would have occurred in 2003 at the South Campbell County site.

Water Resources

Mining would disturb the coal aquifer and the aquifers in the overburden above the coal within the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts. The coal aquifer and any water-bearing strata in the overburden would be removed and replaced with unconsolidated backfill. A continuous cone of depression currently exists around the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines due to their closeness to each other and the cumulative drawdown effects from pit dewatering and nearby CBNG discharges. The extent of drawdown west of the mines that is specifically attributable to mine dewatering can no longer be defined due to much greater and areally extensive drawdown caused by CBNG development. Roughly 30 years of surface mining and the more recent CBNG development have resulted in complete dewatering of the coal aquifer in localized areas, particularly near the mines' pits and where the coal seams are structurally highest. Figure ES-14 shows the extrapolated extent of life-of-mine cumulative drawdown within

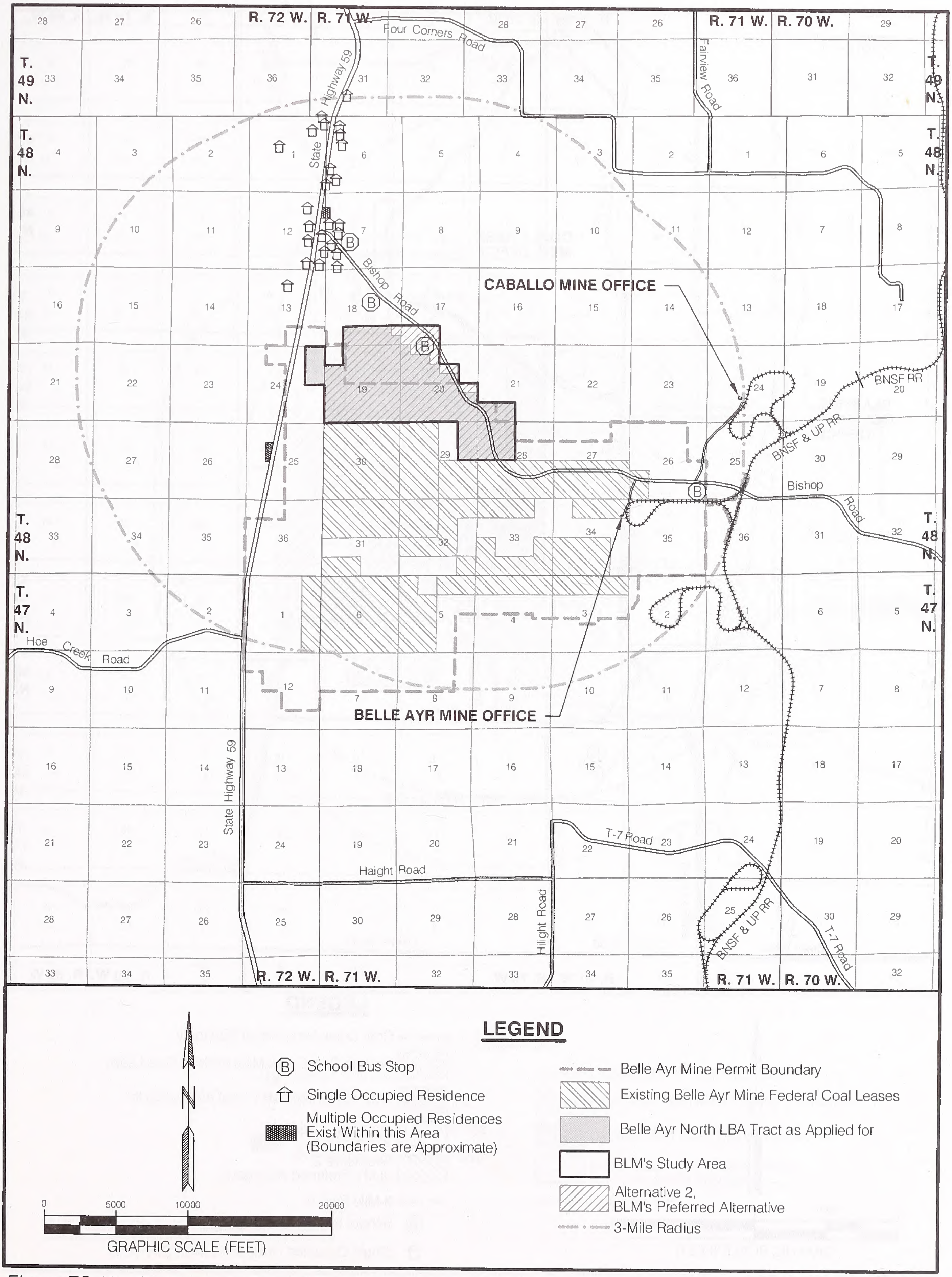


Figure ES-10. Residences, School Bus Stops, Public Roads, and Other Publicly Accessible Facilities Within 3 Miles of the Belle Ayr North LBA Study Area.

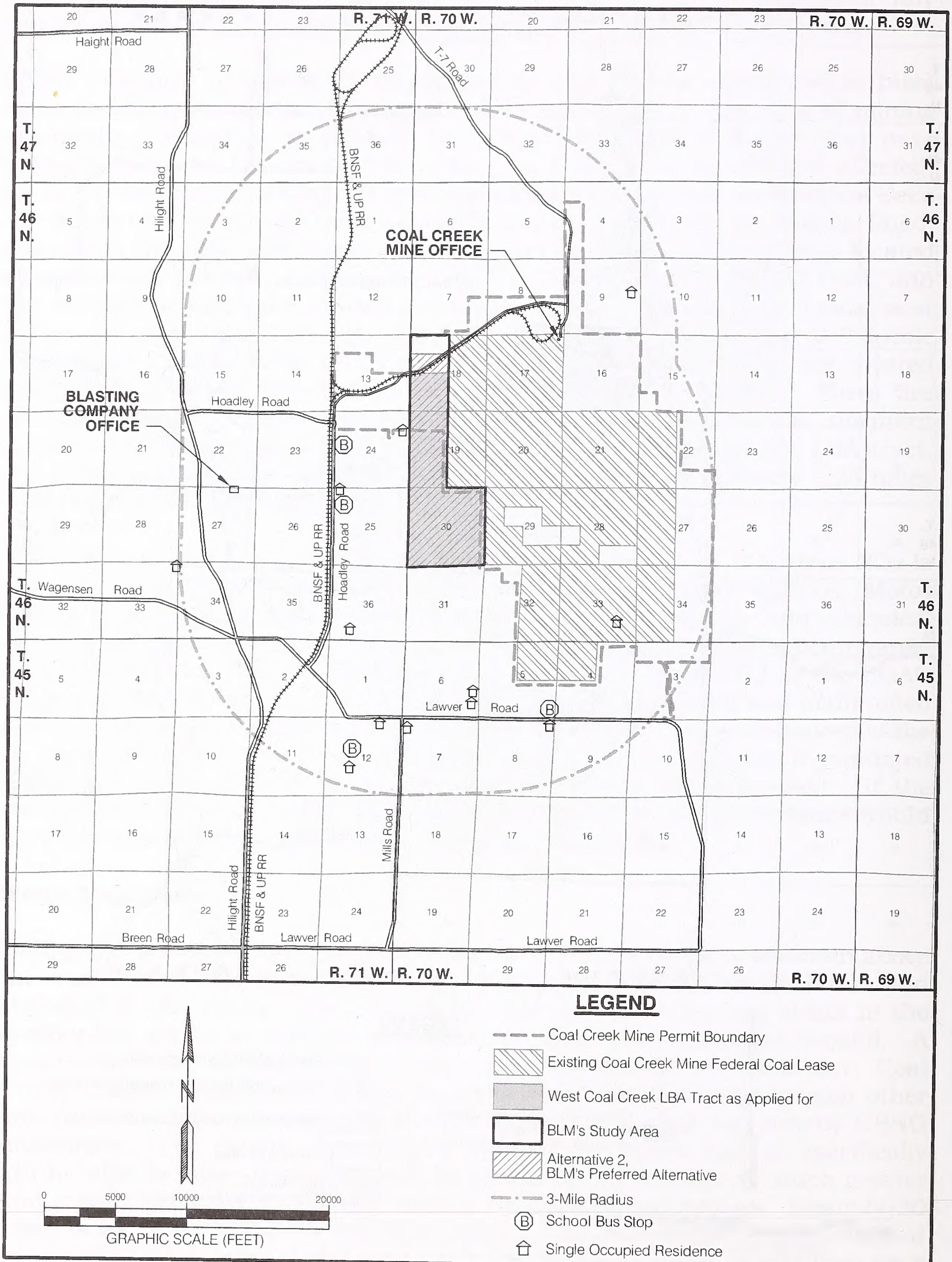


Figure ES-11. Residences, School Bus Stops, Public Roads, and Other Publicly Accessible Facilities Within 3 Miles of the West Coal Creek LBA Study Area.

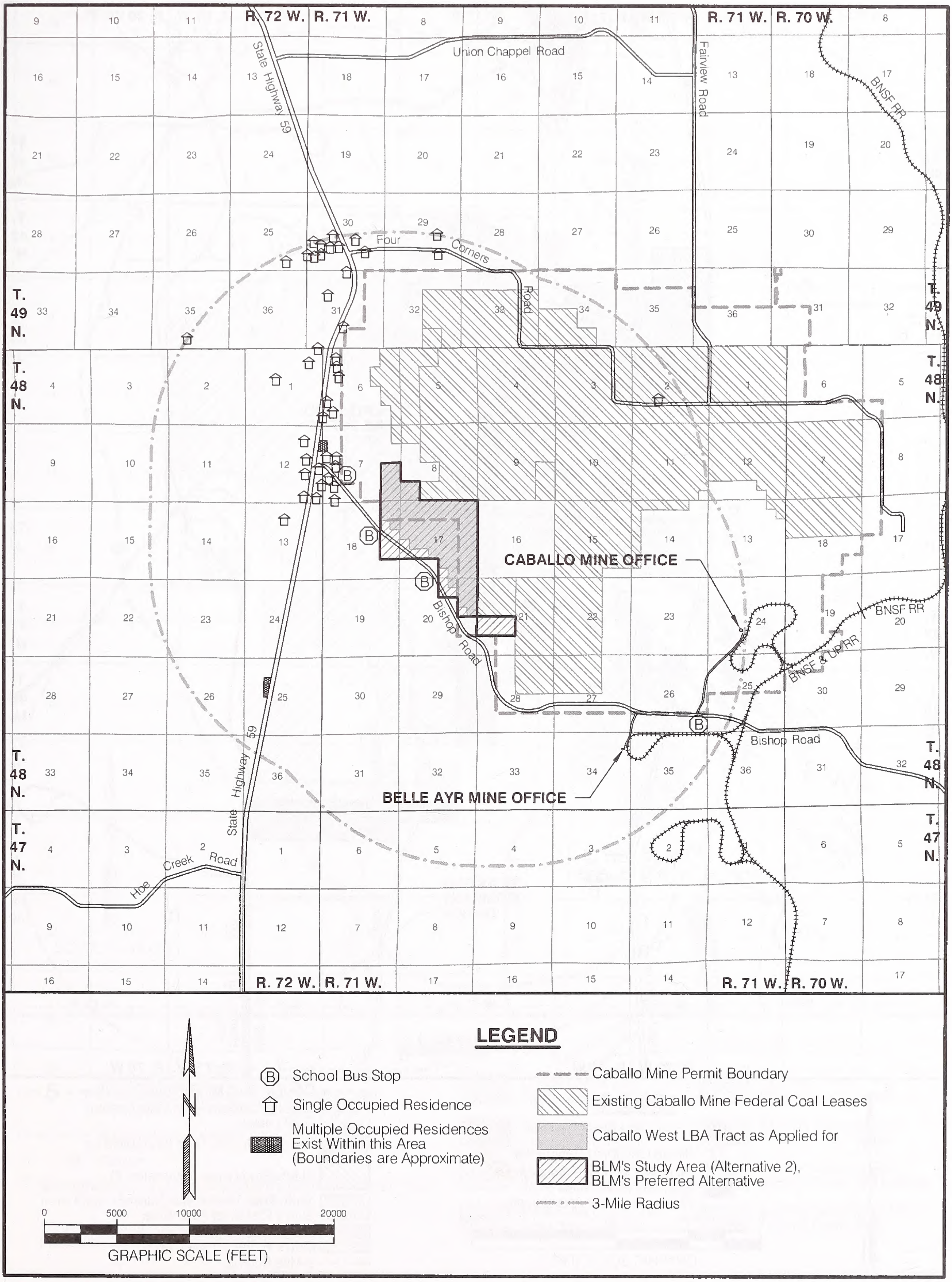


Figure ES-12. Residences, School Bus Stops, Public Roads, and Other Publicly Accessible Facilities Within 3 Miles of the Caballo West LBA Study Area.

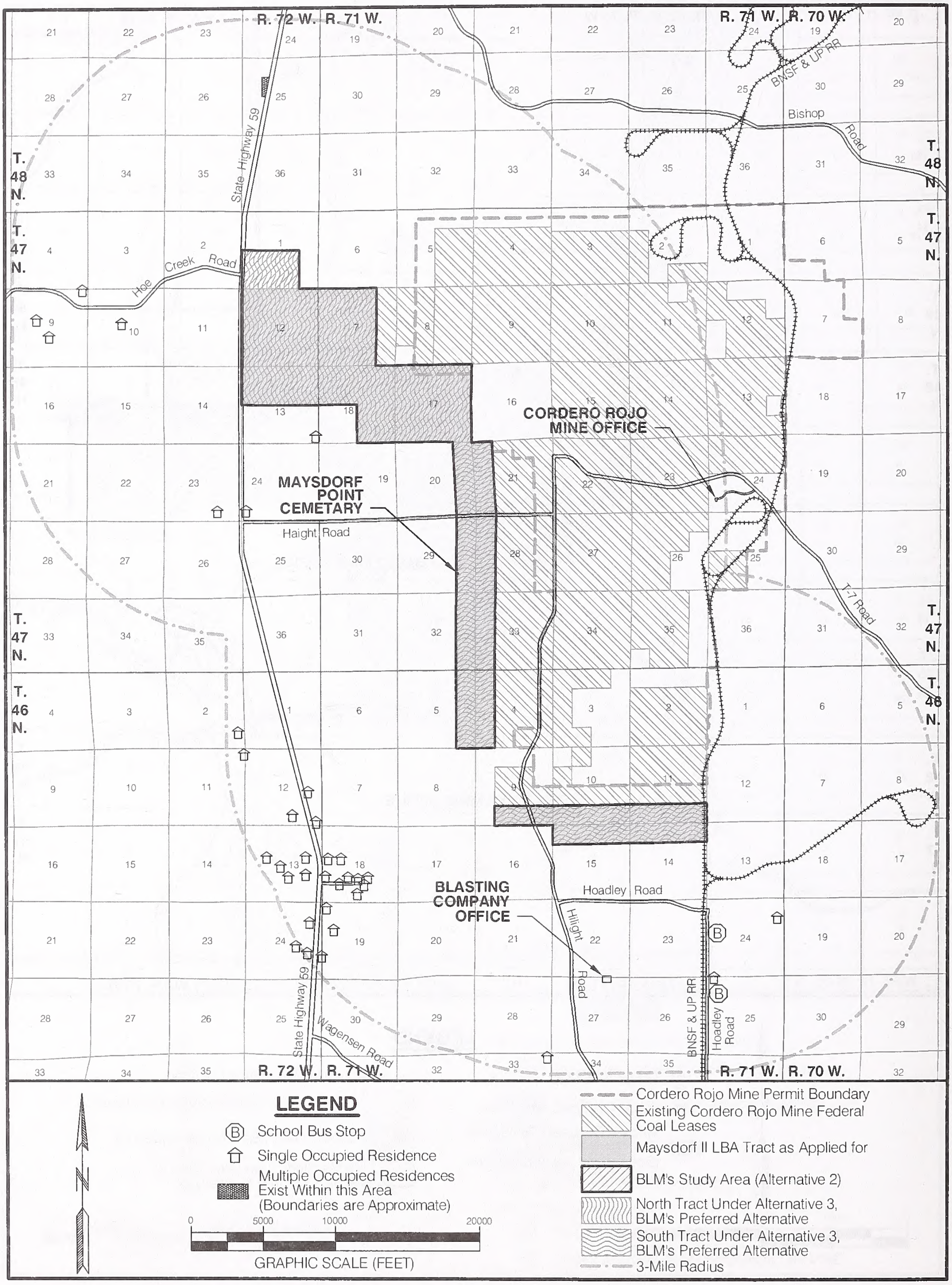


Figure ES-13. Residences, School Bus Stops, Public Roads, and Other Publicly Accessible Facilities Within 3 Miles of the Maysdorf II LBA Study Area.

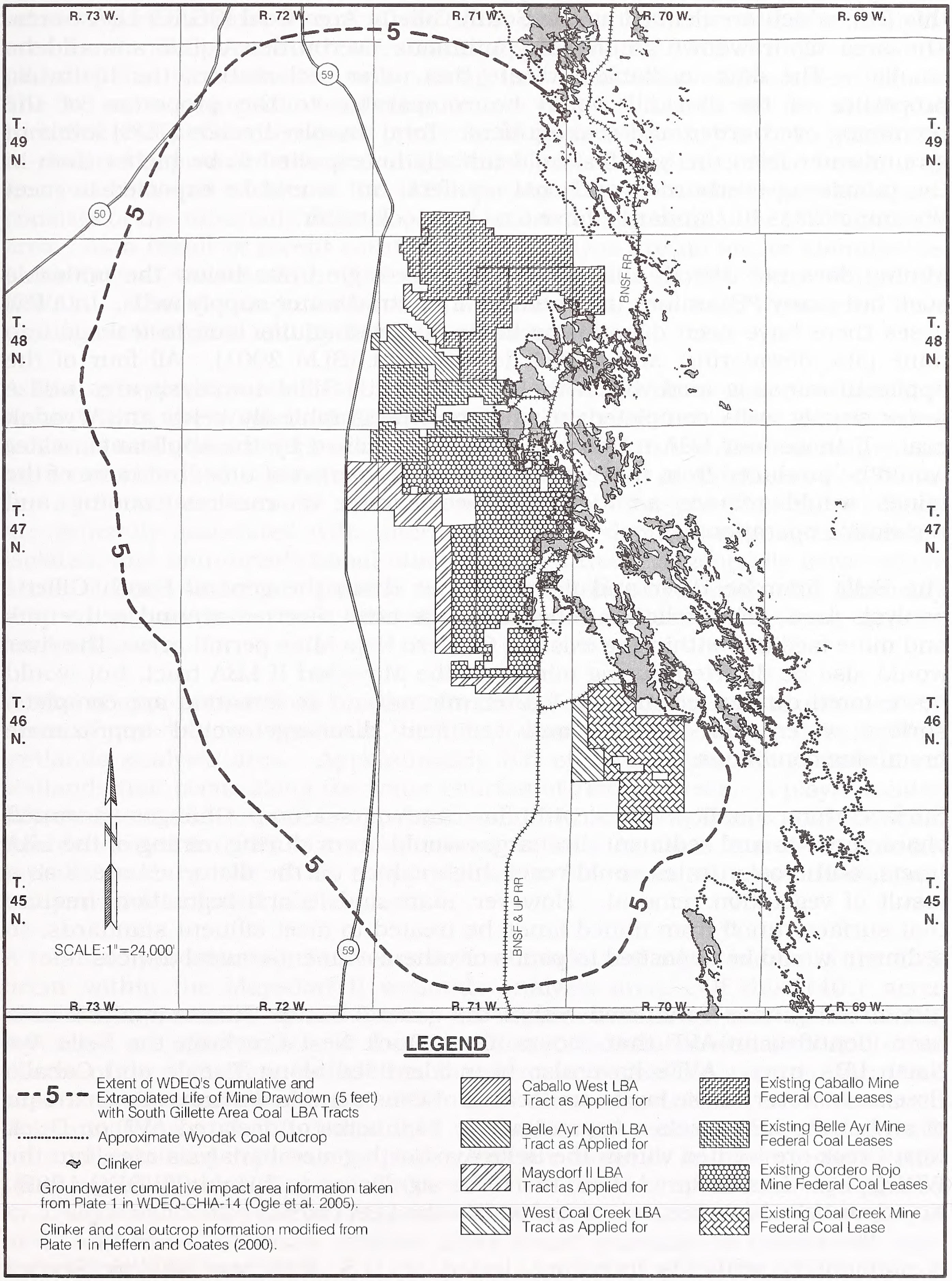


Figure ES-14. Extrapolated Extent of Life of Mine Cumulative Drawdown Within the Wyodak Coal Aquifer With the Addition of the South Gillette Area Coal LBA Tracts.

the Wyodak coal aquifer with the addition of the four LBA tracts discussed in this EIS, which are defined as the South Gillette Area Coal (SGAC) LBA tracts. The area of drawdown in the discontinuous overburden aquifers would be smaller. The data available indicate that, after reclamation, the hydraulic properties of the backfill would be comparable to the properties of the premining overburden and coal aquifers. Total dissolved solids (TDS) levels in groundwater from the backfill could initially be expected to be higher than in the premining overburden and coal aquifers, but would be expected to meet Wyoming Class III standards for use as livestock water.

Mining does not directly disturb the hydrogeologic units below the mineable coal, but many PRB mines use them for industrial water supply wells. In a few cases there have been drawdowns in the subcoal aquifer due to leakage into mine pits, dewatering, and CBNG development (BLM 2001). All four of the applicant mines located within the general South Gillette analysis area utilize water supply wells completed in aquifers stratigraphically below the Wyodak coal. If these four LBA tracts are leased and mined by the applicants, water would be produced from these wells for a longer period of time, but none of the mines would require additional sub-coal wells to continue mining and reclaiming operations.

The Belle Fourche River and its tributaries drain the general South Gillette analysis area. The Belle Fourche River has been diverted around active pits and mine facilities within the existing Cordero Rojo Mine permit area. The river would also be diverted during mining of the Maysdorf II LBA tract, but would be restored during reclamation. After mining and reclamation are complete, surface water flow, quality, and sediment discharge would approximate premining conditions.

Surface water quality varies with flow and/or season. Changes in runoff characteristics and sediment discharges would occur during mining of the LBA tracts, and erosion rates could reach high values on the disturbed areas as a result of vegetation removal. However, state and federal regulations require that surface runoff from mined lands be treated to meet effluent standards, so sediment would be deposited in ponds or other sediment-control devices.

AVF investigations conducted within the general South Gillette analysis area have identified an AVF that occurs along Duck Nest Creek on the Belle Ayr North LBA tract. AVFs have also been identified along Tisdale and Caballo Creeks; however, those lands are located at considerable distances downstream of any of the LBA tracts. Approximately 14.9 acres of declared AVF on Duck Nest Creek are located within the Belle Ayr North general analysis area, but the WDEQ/LQD has declared them not to be significant to farming (WDEQ 1988). No other AVFs have been identified within the LBA tracts.

A preliminary wetlands inventory, based on U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) mapping and vegetation mapping in the field, was conducted for the wetland analysis area for each tract. A total

of approximately 193.9 acres of "waters of the U.S.", including a total of 14.4 acres of jurisdictional waters of the U.S., occur within the wetlands analysis area for the Belle Ayr North LBA tract. Approximately 11.9 of those acres are jurisdictional wetlands that occur along the watercourse of Duck Nest Creek. The 2.5 acres of jurisdictional other waters of the U.S. that did not qualify as jurisdictional wetlands consist primarily of open water that is held within the in-channel impoundments and intermittent pools along Duck Nest Creek. The non-jurisdictional waters of the U.S. contained in the wetlands analysis area consists of the internally drained playas and total approximately 179.5 acres in area. As a result of recent court directives, playas are no longer identified as jurisdictional waters of the U.S. under Section 404 of the Clean Water Act (CWA). These non-jurisdictional wetland features can, however, have significant biological and hydrological importance.

A total of approximately 16.9 acres of wetlands and other waters of the U.S. occur within the West Coal Creek wetlands analysis area. Non-jurisdictional wetlands and other waters of the U.S. were included in the above acreages and were not identified separately because only the Corp of Engineers (COE) has the authorization to make such determinations. Non-jurisdictional wetlands are generally associated with internally drained depressions/playas that are isolated, and non-jurisdictional other waters of the U.S. generally occur where areas of open water are ponded in a depression/playa area. No internally drained playas have been identified within the West Coal Creek general analysis area.

A total of approximately 15.0 acres of waters of the U.S., including a total of 8.6 acres of jurisdictional waters of the U.S., occur within the entire Caballo West wetlands analysis area. Approximately 6.5 of those acres are jurisdictional wetlands that occur along the water courses of Tisdale Creek. A playa, located adjacent to the LBA tract as applied for and within the wetlands analysis area, was delineated in 1996 as a jurisdictional wetland, but was later declared non-jurisdictional by the COE. Approximately 6.4 acres of non-jurisdictional wetlands are included in this playa.

A total of approximately 140.1 acres of wetlands and other waters of the U.S. occur within the Maysdorf II wetlands analysis area. Of this 140.1 acres identified, approximately 133.5 acres are vegetated wetlands and the remaining 6.6 acres are other waters of the U.S. Non-jurisdictional wetlands and other waters of the U.S. were included in the above acreages and were not identified separately because only the COE has the authorization to make such determinations. Non-jurisdictional wetlands are generally associated with internally drained depressions/playas that are isolated, and non-jurisdictional other waters of the U.S. generally occur where areas of open water are ponded in a depression/playa area. Approximately 49.9 acres of playas occur in the area, and those internally drained areas would probably be considered non-jurisdictional by the COE.

Existing wetlands located in the LBA tracts would be destroyed by mining operations. Jurisdictional wetlands that are disturbed by mining must be replaced during the reclamation process.

Soils and Vegetation Resources

Consequences to soil resources from mining the LBA tracts would include changes in the physical, biological, and chemical properties. Following reclamation, the soils would be unlike premining soils in texture, structure, color, accumulation of clays, organic matter, microbial populations, and chemical composition. The replaced topsoil would be more uniform in type, thickness, and texture. It would be adequate in quantity and quality to support planned postmining land uses (i.e., wildlife habitat and rangeland).

The predominant vegetation types, in terms of total acres of occurrence in the combined vegetation general analysis areas, are the sagebrush/grassland (38.1 percent) and sandy grassland (18.4 percent). Common plant species on these types include crested wheatgrass, smooth brome, needleandthread, threadleaf sedge, western wheatgrass, blue grama, and cheatgrass brome. Dominant shrubs/subshrubs in these vegetation communities include Wyoming big sagebrush and fringed sage. Lichens and manyspine plains pricklypear cactus are frequently large components of the vegetation cover. Mining would progressively remove this native vegetation. Reclamation and revegetation of mined areas would occur contemporaneously with mining on adjacent lands. Reestablished vegetation would be dominated by species mandated in the reclamation seed mixtures, which are approved by the WDEQ/LQD. The majority of these species would be native to the LBA tracts. Initially, the reclaimed land would be dominated by grassland vegetation, which would be less diverse than the premining vegetation. Estimates for the time it would take to restore sagebrush to premining density levels range from 20 to 100 years. An indirect long-term impact associated with this vegetative change would potentially be a decrease in available habitat for shrub-dependent species. However, a diverse, productive, and permanent vegetative cover would be established on the LBA tracts within about 10 years following reclamation, prior to release of the final reclamation bond. The decrease in plant diversity would not seriously affect the potential productivity of the reclaimed areas, and the proposed postmining land uses (wildlife habitat and rangeland) should be achieved even with the changes in vegetation composition and diversity. The reclamation plans for the LBA tracts would also include steps to control invasion by weedy (invasive, nonnative) plant species.

Wildlife Resources

Direct impacts of surface coal mining on wildlife occur during mining and are short term. They include road kills by mine-related traffic, direct losses of less mobile wildlife species, restrictions on wildlife movement created by fences, spoil piles and pits, displacement of wildlife from existing habitat in areas of active mining (including abandonment of nests or nesting and breeding habitat

for birds), increased competition between animals in areas adjacent to mining operations, and increased noise, dust, and human presence. Habitat for aquatic species would also be lost during mining operations. Indirect impacts are longer term and include alterations in topography and vegetative cover following reclamation, which may decrease wildlife carrying capacity and habitat diversity. The Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts do not include any unique or crucial big game habitat, and habitat disturbance would be incremental, with reclamation progressing as new disturbance occurs. The West Coal Creek LBA tract is adjacent to a sage-grouse "core population area", as defined by the Sage-Grouse Implementation Team (Sage-Grouse Implementation Team 2008). A total of 14 sage-grouse leks have been documented on and within 2 miles of the general analysis areas for these four LBA tracts. Six of the leks have been active during recent survey years and are classified as occupied; three leks have not been attended by displaying grouse for at least the last 10 years and are classified as unoccupied/abandoned; and five leks have been removed by mining activities and are classified as unoccupied/destroyed. In the long term, following reclamation, wildlife carrying capacity and habitat diversity may be reduced due to gentler topography, less diverse vegetative cover, and reduction in sagebrush density. Mining companies have initiated efforts in recent years to increase the diversity of post-mine topography and to increase the amount of sagebrush in the reclamation.

Threatened and Endangered Species

T&E plant and animal species that could be present on the tracts include the Ute ladies'-tresses orchid, blowout penstemon, and black-footed ferret. Areas of suitable habitat for the Ute ladies'-tresses orchid within the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts and adjacent study areas were surveyed in August 2006 and 2007, July 2007, August 2007, and in August 2005 and 2006, respectively, and no individuals were located. The LBA tracts are not within the documented historical range of the blowout penstemon. No suitable sand dunes (whether stable or blown out) are currently present on tract general analysis areas. The black-footed ferret is a nocturnally active mammal that depends almost entirely upon the prairie dog for its survival. No black-tailed prairie dog colonies are currently present on the LBA tracts as proposed and the area added by action alternatives. One small colony (approximately 40 acres) is within the Maysdorf II wildlife general analysis area and one small colony (approximately 56 acres) is located just over 1 mile southwest of the Maysdorf II wildlife general analysis area. One small colony (approximately 34 acres in size) is located approximately 1 mile south of the West Coal Creek LBA tract study area.

Land Use and Recreation

Approximately 97 percent of the surface estate of the SGAC LBA tracts is owned by private individuals/companies. Most of the subsurface minerals (all of the coal and approximately 90 percent of the oil and gas estate) are federally

owned, which results in split estate situations. The BLM's split estate policy only applies to situations where the surface rights are in private ownership and the rights to development of the mineral resources are publicly held and managed by the federal government.

Active mining within the LBA tracts would preclude other land uses. Recreational and grazing uses of the tracts would be severely limited during mining. Oil and gas development would be curtailed, and coal within the targeted seams containing any unrecovered CBNG would be removed. Within 10 years after initiation of each reclamation phase, rangeland and wildlife use would return to near premining levels.

Cultural Resources

The Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts have been surveyed for cultural resources at the Class I level. A majority of the tracts have been surveyed to a Class III level. A total of 73 cultural sites and 67 isolated finds were documented in the survey areas. Of the 73 cultural sites, 44 are prehistoric, 20 are historic, and nine are multi-component. Eight of the sites are recommended as eligible to the National Register of Historic Places (NRHP) and 11 are unevaluated. Until consultation with State Historic Preservation Office (SHPO) has occurred and agreement regarding NRHP eligibility has been reached, all sites would be protected from disturbance. Any area within the LBA tracts not yet surveyed to a Class III level would require a Class III survey prior to disturbance.

No sites of Native American religious or cultural importance have been identified on the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts. Appropriate action must be taken to address concerns related to those sites if such sites or localities are identified at a later date.

Visual Resources

Some mining activities on the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts would be visible from Wyoming 59 and several county roads in the vicinity of the tracts. Mining would affect landscapes classified by BLM as visual resource management (VRM) Class V. The landscape character would not be significantly changed following reclamation. No unique visual resources have been identified on or near the LBA tracts.

Noise

There are occupied dwellings and businesses located in the vicinity of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts (figures ES-11, ES-12, ES-13, and ES-14, respectively). These facilities would experience an adverse noise impact if mining activities (particularly blasting) occur within 2,500 feet (0.47 mile) of them under either the proposed actions or action alternatives. At distances of approximately 2,500 feet or greater, the

noise intensity of mining activities would be reduced to 55 dBA (no adverse impact level).

Transportation

Leasing the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts would extend the length of time that coal is shipped from the permitted Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines, respectively, which would extend the length of time that coal transportation facilities would be required. Vehicular traffic to and from the mines would continue for over 10 additional years, depending on the LBA tracts involved and which alternatives are selected. Lands within 100 feet of the outside line of the ROW of a public road are considered unsuitable for leasing; however, they could be included in a tract to allow recovery of economically mineable coal outside of the ROW and buffer zone. Active pipelines and utility/power transmission lines would have to be relocated in accordance with previous agreements, or agreements would have to be negotiated for their removal or relocation.

Socioeconomics

Royalty and bonus payments for the coal in the LBA tract would be collected by the federal government and split with the state. Assuming an average coal price of $9.98 per ton recovered and a potential range of bonus payments of 30 to 97 cents per ton, the potential additional federal revenues from the four LBA tracts would range from approximately $1.1 to $1.4 billion, depending on the alternative selected and the bonus price at the time the coal is leased. The potential additional revenue to the state of Wyoming from the four LBA tracts would range from $1.4 to $1.8 billion, depending on the alternative selected, the bonus price at the time the coal is leased, and the selling price of the coal. Mine life and employment (at or slightly above current levels) would be extended for over 10 additional years, depending on the LBA tracts involved and which alternatives are selected.

Greenhouse Gas Emissions

Equivalent carbon dioxide (CO_2e) emissions are projected to increase at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines if the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts are added to the mining operations. The increase in CO_2e emissions would result from the additional fuels (especially diesel) that would be used in consideration of the increased coal and overburden haul distances, as well as increased use of electricity and explosives related to increasing overburden thicknesses. With the addition of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts, the estimated total CO_2e emissions at the four applicant mines would represent 1.7 percent of the projected 2020 statewide CO_2e emissions.

Environmental Justice

Potentially adverse impacts do not disproportionately affect minorities, low-income groups or Native American tribes or groups. No tribal lands or Native American communities are included in this area, and no Native American treaty rights or Native American trust resources are known to exist for this area.

No Action Alternatives (Alternative 1)

Under the No Action alternatives for each tract, the coal lease applications would be rejected and the areas contained in the applications would not be offered for lease at this time. The tracts could be nominated for lease again in the future. Also under the No Action alternative, the impacts described in the preceding paragraphs to topography and physiology, geology and minerals, soils, air quality, water resources, AVFs, wetlands, vegetation, wildlife, T&E species, land use and recreation, cultural resources, Native American concerns, paleontological resources, visual resources, noise, transportation, and socioeconomics would occur due to mining the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine coal leases, but these impacts would not be extended by mining onto the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts, respectively.

Mitigation

The Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines currently approved mining permits include extensive baseline information, ongoing monitoring information and commitments, and mitigation measures that are required by SMCRA and Wyoming State Law. Compliance, mitigation, and monitoring measures that are required by regulation are considered to be part of the proposed actions and alternatives considered in this EIS. These regulatory requirements, mitigation measures and monitoring commitments are in place for the No Action alternative as part of the currently approved mining and reclamation plans for the four applicant mines and would be included in the permitting processes that would be required to mine the four South Gillette area LBA tracts.

If impacts are identified during the leasing process that are not mitigated by existing required mitigation measures, BLM can include additional mitigation measures, in the form of stipulations on a new lease, within the limits of its regulatory authority. Any special stipulations identified by BLM where additional or increased monitoring measures are recommended to be added to the BLM leases are included in appendix D of this EIS.

Cumulative Impacts

Cumulative impacts result from the incremental impacts of an action added to other past, present, and reasonably foreseeable future actions, regardless of

who is responsible for such actions. Cumulative impacts can result from individually minor, but collectively significant, actions occurring over time.

Since decertification of the Powder River federal coal region in 1990, 20 coal leases containing more than 5.8 billion tons of federal coal have been issued following competitive sealed-bid sales. Three exchanges of federal coal in the Wyoming portion of the Powder River Federal Coal Region have also been completed. Twelve additional coal lease applications, including the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tract applications, are pending. The pending LBA applications contain over 3.8 billion tons of coal.

Currently, BLM is completing a regional technical study, called the PRB Coal Review, to help evaluate the cumulative impacts of coal and other mineral development in the PRB. The study evaluates conditions as of a baseline year (2002 or 2003) and projects development levels and potential associated cumulative impacts related to coal and coal-related development, oil and gas and related development, and other development through 2020. Due to variables associated with future coal production, two projected coal production scenarios (representing an upper and a lower production level) were developed. The projected development levels are based on projected demand and coal market forecasts and include production at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines during the baseline year and projected production for 2010, 2015, and 2020.

The Wyoming portion of the PRB is the primary focus of the PRB Coal Review, but the Montana portion of the PRB is included in some studies. A series of reports have been prepared or are being prepared to present the result of the PRB Coal Review studies. The results of the PRB Coal Review studies that have been completed are summarized in section 4.0 of this EIS.

Cumulative impacts vary by resource, with potential impacts to air quality, groundwater quantity, wildlife habitat, and socioeconomics generally being the greatest concerns.

The original PRB Coal Review air quality study documented the modeled air quality impact of existing operations during a baseline year, 2002, and of projected development activities in 2010. BLM updated the model in 2008 and conducted the cumulative air quality impact analysis using a revised baseline year of 2004 with development levels projected for year 2015. The model was used to evaluate impacts of baseline and projected source emissions on several source groups, including near-field receptors in Wyoming and Montana, receptors in nearby federally designated "Class I" areas, and receptors at "Class II" sensitive areas. The EPA guideline CALPUFF model system was used for the modeling analysis.

The existing regional air quality conditions are generally very good, but the modeling showed substantial impacts at some receptors for 2004 and 2015.

The model results should not be construed as predicting an actual exceedance of any standard, but are at best forecasts that indicate potential impacts (BLM 2008e). Table ES-8 presents the maximum modeled impacts on ambient air quality at the near-field receptors in Wyoming and Montana for 2004 and for the 2015 upper and lower coal development scenarios. Table ES-9 lists the projected modeled visibility impacts for 2004 for all analyzed Class I and sensitive Class II areas. For the upper and lower coal production scenarios, it shows the number of additional days that the impacts were projected to be greater than 1.0 dv (10 percent in extinction) for each site in 2015.

The PRB Coal Review provides an assessment of the cumulative impact to surface and groundwater resources associated with future projected levels of coal mining, coal mine dewatering, CBNG groundwater withdrawal and surface disposal, and coal mine and conventional oil and gas surface disposal of groundwater. The groundwater portion of the impact analysis has not yet been completed. The surface water analysis addresses the cumulative impacts to surface water quality and channel stability because of surface discharge of groundwater by CBNG development and coal mine dewatering. The surface water quality portion of this analysis has been completed, but the channel stability portion has not. A number of modeling analyses have previously been conducted to help predict the impacts of surface coal mining on groundwater resources in the PRB. In addition, each mine must monitor groundwater levels in the coal and underlying and overlying aquifers and assess the probable hydrologic consequences of mining as part of the mine permitting process. The monitoring programs track the extent of groundwater drawdown propagation to the west and the extent of recharge and quality of the water in the backfill areas of the mines. The monitoring data indicate that recharge is occurring in the backfill, and that water from the backfill will generally be acceptable for premining uses (primarily livestock watering). Modeling and monitoring indicate that the groundwater drawdown impacts of coal mining and CBNG development are overlapping.

The PRB Coal Review studies include an evaluation of the impacts to wildlife and aquatic species as of 2003 and an evaluation of the projected levels of disturbance in the PRB in 2010, 2015, and 2020, based on the projected development levels in those years. As discussed above, impacts to wildlife and fisheries can be classified as short-term and long-term. Short-term impacts are related to habitat disturbance during project development and operation. Long-term impacts result from changes in habitat after reclamation is completed. Habitat fragmentation can result from activities such as roads, well pads, mines, pipelines, and electrical power lines, as well as increased noise, elevated human presence, dispersal of noxious and invasive weed species, and dust from unpaved road traffic.

The cumulative impacts of energy development (coal mining, oil and gas) in the PRB are and will continue to contribute to a reduction in hunting opportunities for some animals (pronghorn, mule deer, and sage grouse).

Table ES-8. Projected Maximum Potential Near-field Impacts (µg/m³).

Pollutant	Averaging Time	Base Year (2004) Impacts	2015 Lower Coal Development Scenario Impacts	2015 Upper Coal Development Scenario Impacts	NAAQS	Wyoming AAQS	Montana AAQS	PSD Class II Increments
Wyoming Near-field								
NO_2	Annual	31.3	46.7	47.4	100	100	--[1]	25
SO_2	Annual	15.3	16.2	16.2	80	60	---	20
	24-hour	112.3	119.6	119.6	365	260	---	91
	3-hour	462.0	814.1	814.1	1,300	1,300	---	512
PM_{10}	Annual	38.4	**53.5**	**61.0**	---	50	---	17
	24-hour	**250.4**	**512.8**	**512.9**	150	150	---	30
Montana Near-field								
NO_2	Annual	3.3	6.5	6.5	100	---	100	25
	1-hour	409.0	**826.3**	**826.4**	---	---	564	---
SO_2	Annual	1.6	1.7	1.7	80	---	80	20
	24-hour	16.1	16.5	16.6	365	---	365	91
	3-hour	65.0	66.5	66.5	1,300	---	1,300	512
	1-hour	162.9	166.6	166.6	---	---	1,300	---
PM_{10}	Annual	2.8	5.2	5.3	---	---	50	17
	24-hour	29.1	44.0	58.5	150	---	150	30

[1] No standard or increment.
Bold values indicate exceedance of ambient air quality standards (AAQS).
Source: PRB Coal Review Task 3A Report (BLM 2008h)

Table ES-9. Modeled Change in Visibility Impacts at Class I and Sensitive Class II Areas.

Location	2004 No. of Days >10%	2015 Lower Development Scenario Change in No. of Days > 10%	2015 Upper Development Scenario Change in No. of Days > 10%
Federally and Tribally Designated Class I Areas			
Badlands National Park	218	26	26
Bob Marshall Wilderness Area	8	0	0
Bridger Wilderness Area	144	2	2
Fitzpatrick Wilderness Area	91	2	2
Fort Peck Indian Reservation	105	10	10
Gates of the Mountain Wilderness Area	55	0	0
Grand Teton National Park	70	2	2
North Absaroka Wilderness Area	61	3	3
North Cheyenne Indian Reservation	243	32	47
Red Rock Lakes	42	2	2
Scapegoat Wilderness Area	27	1	1
Teton Wilderness Area	57	4	4
Theodore Roosevelt National Park	178	5	9
UL Bend Wilderness Area	77	8	10
Washakie Wilderness Area	83	5	5
Wind Cave National Park	262	18	19
Yellowstone National Park	84	2	2
Sensitive Class II Areas			
Absaroka Beartooth Wilderness Area	101	2	3
Agate Fossil Beds National Monument	251	20	20
Big Horn Canyon NRA	331	1	3
Black Elk Wilderness Area	236	34	36
Cloud Peak Wilderness Area	126	18	18
Crow Indian Reservation	360	4	4
Devils Tower National Monument	274	25	26
Fort Belknap Indian Reservation	66	6	7
Fort Laramie National Historic Site	260	10	10
Jedediah Smith Wilderness Area	79	1	1
Jewel Cave National Monument	261	19	21
Lee Metcalf Wilderness Area	97	2	2
Mount Naomi Wilderness Area	51	1	1
Mount Rushmore National Monument	222	36	36
Popo Agie Wilderness Area	139	4	4
Soldier Creek Wilderness Area	268	18	18
Wellsville Mountain Wilderness Area	130	10	10
Wind River Indian Reservation	217	2	5

Source: PRB Coal Review Task 3A Report (BLM 2008h)

The PRB Coal Review used the Regional Economic Models Inc's. (REMI) Policy Insight regional economic model to project cumulative employment and population levels and associated impacts in the PRB for the upper and lower coal production scenarios in 2010, 2015, and 2020. Table ES-10 presents the recent and projected population levels for the counties included in the PRB Coal Review socioeconomic analysis.

Table ES-10. Recent and Projected PRB Population.

Year	Campbell County	Converse County	Crook County	Johnson County	Sheridan County	Weston County	Total Study Area
				Census			
2000	33,698	12,104	5,895	7,108	26,606	6,642	92,053
2003	36,438	12,314	5,986	7,554	27,115	6,671	96,078
2007	40,433	12,868	6,284	8,142	27,998	6,854	102,579
			Lower Coal Production Scenario				
2010	45,925	13,103	6,542	8,389	28,459	7,108	109,526
2015	48,905	13,671	6,759	8,867	30,016	7,174	115,392
2020	50,995	14,193	6,989	9,326	31,467	7,208	120,178
			Upper Coal Production Scenario				
2010	47,662	13,160	6,570	8,424	28,579	7,137	111,532
2015	51,558	13,763	6,802	8,924	30,214	7,219	118,480
2020	54,943	14,313	7,045	9,403	31,733	7,266	124,703

Source: U.S. Census Bureau (2007 - historical data) and PRB Coal Review Task 3C Report (BLM 2005e)

This FEIS presents BLM's analysis of environmental impacts under authority of the NEPA and associated rules and guidelines. BLM will use this analysis to make a leasing decision. The decision to lease these lands is a necessary requisite for mining, but it is not in itself the enabling action that will allow mining. The most detailed analysis prior to mine development would occur after the lease is issued, when the lessee files an application for a surface mining permit and mining plan approval, supported by extensive mining and reclamation plans, to the WDEQ/LQD.

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LIST OF APPENDICES

Abbreviations and Acronyms Used in this Report

AAQS	Ambient Air Quality Standards
Ac	acre(s)
ACC	Antelope Coal Company
ac-ft	acre-foot, acre-feet
ac-ft/yr	acre-foot per year, acre-feet per year
AIRS	Aerometric Information and Retrieval System
ALC	Ark Land Company
AML	Abandoned Mine Land
ANC	acidification neutralization capacity
ANFO	ammonium nitrate fuel oil
APLIC	Avian Power Line Interaction Committee
AQD	Air Quality Division
AQIA	air quality impact analysis
AQRV	air quality related values
ARCO	Atlantic Richfield Company
ARS	Air Resource Specialists, Inc.
AUM	animal unit month
AVF	alluvial valley floor
BACT	best available control technology
bcf	billion cubic feet
bcy	bank cubic yards
BLM	Bureau of Land Management
BNSF	Burlington Northern Santa Fe
BNSF-UP, BNSF&UP	Burlington Northern Santa Fe and Union Pacific
BN-UP, BN&UP	Burlington Northern-Union Pacific
BOE	barrels of oil equivalent
B.P.	before present
Btu	British thermal units
Btu/lb	British thermal units per pound
CAA	Clean Air Act
CAAA	Clean Air Act Amendment
CAGR	compounded annual growth rate
CANDO	Converse Area New Development Organization
CBNG	coal bed natural gas
CCBC	Campbell County Board of Commissioners
CCC	Caballo Coal Company
CCEDC	Campbell County Economic Development Corporation
CCSD	Campbell County School District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHIA	Cumulative Hydrologic Impact Assessment
CMC	Cordero Mining Company
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	equivalent carbon dioxide
COE	U.S. Army Corps of Engineers
CREG	Consensus Revenue Estimating Group
CRI	Caballo Rojo, Inc.
CWA	Clean Water Act

Abbreviations and Acronyms Used in this Report

cy	cubic yards
dBA	A-weighted decibels
DEIS	Draft Environmental Impact Statement
DM&E	Dakota, Minnesota & Eastern Railroad Corporation
DNRC	Department of Natural Resources and Conservation
DOI	Department of the Interior
dv	deciview, a measure of view impairment
EA	Environmental Assessment
EC	elemental carbon particles (re: air quality)
EIS	Environmental Impact Statement
ENCOAL	Encoal Corporation
EOR	enhanced oil recovery
EPA	Environmental Protection Agency
EQC	Environmental Quality Council
ESA	Endangered Species Act
EUR	estimated ultimate recovery
EVG	Erathem-Vanir Geological, PLLC
F	Fahrenheit
FAA	Federal Aviation Administration
FCLAA	Federal Coal Leasing Act Amendments of 1976
FCW	Foundation Coal West, Inc.
FDM	Fugitive Dust Model
FEA	Final Environmental Assessment
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FLM	Federal Land Management
FLPMA	Federal Land Policy Management Act of 1976
FR	Federal Register
FRA	Federal Railroad Administration
ft	feet, foot
ft/day	feet per day
ft/mile	feet per mile
ft^3	cubic feet
FY	fiscal year
g	Gram
GAO	General Accounting Office
GAGMO	Gillette Area Ground Water Monitoring Organization
gpm	gallons per minute
GSP	Gross State Product
HAP	Hazardous Air Pollutant
HIA	health impact assessment
hp	horsepower
hr	hour
IBLA	Interior Board of Land Appeals
ISCLT3	Industrial Source Complex Model, Long Term Version 3
IMPROVE	Interagency Monitoring of Protected Visual Environments
km	kilometers
kV	kilovolts
LAC	limits of acceptable change (re: air quality)
LBA	lease by application
lbs/mmBtu	pounds per million British thermal units

Abbreviations and Acronyms Used in this Report

LFC	liquids from coal
LNCM	Lands Necessary to Conduct Mining
LOP	life of project
LRMP	Land and Resource Management Plan
LRPL	most restrictive proposed limits
LW	Lower Wyodak coal seam
MACT	Maximum Achievable Control Technology
MBHFI	migratory birds of high federal interest
µmhos/cm	micromhos per centimeter
mcf	thousand cubic feet
MDEQ	Montana Department of Environmental Quality
MDEQ/AWM	Montana Department of Environmental Quality/Air and Waste Management Bureau
MEI	maximally exposed individual
µeq/L	microequivalents per liter
$\mu g/m^3$	micrograms per cubic meter
mg/L	milligrams per liter
MLA	Mineral Leasing Act of 1920
MLE	most likely exposure
mm	million
mmbcy	million bank cubic yards
mmbo	million barrels of oil
mmcf	million cubic feet
mmcfpd	million cubic feet of gas per day
mmgpy	million gallons per year
mmt	million tons
mmtpy	million tons per year
mph	miles per hour
MRPL	most restrictive proposed limits
MSA	Metropolitan Statistical Area
MSHA	Mine Safety & Health Administration
MW	Megawatts
NAAQS	National Ambient Air Quality Standards
NADP	National Atmospheric Deposition Program
NAPG	North American Power Group
NCTA	National Coal Transportation Association
NEPA	National Environmental Policy Act of 1969
NERC	North American Electric Reliability Corporation
NIOSH	National Institute of Occupational Safety and Health
NO	nitrogen oxide
NOAA	National Oceanic and Atmospheric Administration
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPDES	National Pollution Discharge Elimination System
NPS	National Park Service
NRCS	National Resource Conservation Service
NRHP	National Register of Historic Places
NSPS	National Source Performance Standards
NWI	National Wetlands Inventory
NWLWG	Northeast Wyoming Local Sage-Grouse Working Group
O_3	photochemical oxidants

Abbreviations and Acronyms Used in this Report

OC	organic carbon particles
ORV	off road vehicle
OSHA	Occupational Safety and Health Administration
OSM	Office of Surface Mining Reclamation & Enforcement
OWUS	other waters of the U.S.
PECs	passive enclosure control systems
PFYC	Probable Fossil Yield Classification
P.M.	Prime Meridian
$PM_{2.5}$	particulates finer than 2.5 microns in effective diameter
PM_{10}	particulates finer than 10 microns in effective diameter
PMT	postmining topography
ppm	parts per million
PRB	Powder River Basin
PRBRC	Powder River Basin Resource Council
PRCC	Powder River Coal Company
PRRCT	Powder River Regional Coal Team
PSD	Prevention of Significant Deterioration
R2P2	Resource Recovery and Protection Plan
RAG	RAG Coal West, Inc.
RH	relative humidity
RMP	Resource Management Plan
ROD	Record of Decision
ROW	Right-of-Way
RV	recreational vehicle
SAR	sodium adsorption ratio
SARA	Superfund Amendment & Reauthorization Act of 1986
scf/ton	standard cubic feet per ton
SCSD	Sheridan County School District
SEIS	Supplemental Environmental Impact Statement
SEO	State Engineer's Office
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SMCRA	Surface Mining Control and Reclamation Act of 1977
SO_2	sulfur dioxide
SO_x	sulfur oxides
SPL	Sound pressure level
SPRB	South Powder River Basin
STB	Surface Transportation Board
T&E	threatened and endangered
TBCC	Thunder Basin Coal Company, LLC
TBNG	Thunder Basin National Grassland
TCO	temporary cessation of operations
TDS	total dissolved solids
TJS	Thunderbird, Jones & Stokes
TPY	tons per year
TSP	total suspended particulates
TSS	total suspended solids
UP	Union Pacific
U.S.	United States
USC, U.S.C.	United States Code
USDA	U.S. Department of Agriculture

Abbreviations and Acronyms Used in this Report

USDI	U.S. Department of the Interior
USGS	U.S. Geological Survey
USFS	U.S. Department of Agriculture - Forest Service
USFWS	U.S. Fish and Wildlife Service
UW	University of Wyoming
VMT	vehicle miles traveled
VOCs	volatile organic compounds
VRM	visual resource management
WA	Wilderness Area
WAAQS	Wyoming Ambient Air Quality Standards
WAQSR	Wyoming Air Quality Standards and Regulations
WARMS	Wyoming Air Resources Monitoring System
WCIC	Wyoming Coal Information Committee
WDEQ	Wyoming Department of Environmental Quality
WDEQ/AQD	Wyoming Department of Environmental Quality/Air Quality Division
WDEQ/LQD	Wyoming Department of Environmental Quality/Land Quality Division
WFA	Western Fuels Association
WGFD	Wyoming Game and Fish Department
WMA	Wyoming Mining Association
WOC	Wyoming Outdoor Council
WOGCC	Wyoming Oil and Gas Conservation Commission
WoUS	Waters of the U.S.
WRCC	Western Regional Climate Center
WRRI	Water Resources Research Institute
WSBLC	Wyoming State Board of Land Commissioners
WSFC	Wyoming School Facilities Commission
WSGS	Wyoming State Geological Survey
WSO-RMG	Wyoming State Office Reservoir Management Group (BLM)
WYDOT	Wyoming Department of Transportation

1.0 INTRODUCTION

This environmental impact statement (EIS)[1] analyzes the environmental impacts of leasing four tracts of federal coal reserves adjacent to the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines. All are operating surface coal mines in the east-central Powder River Basin (PRB) of Wyoming. The operators of the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines filed four applications to lease the four tracts of federal coal included in maintenance coal tracts (federal coal tracts that would continue or extend the life of an existing coal mine) under the regulations at 43 CFR 3425, Leasing On Application. The Division of Minerals and Lands at the Bureau of Land Management (BLM) Wyoming State Office reviewed all four applications and determined that the lease applications met the regulatory requirements for lease by applications (LBAs). The tracts are referred to as the Belle Ayr North LBA tract, the West Coal Creek LBA tract, the Caballo West LBA tract, and the Maysdorf II LBA tract. Figure 1-1 shows the four LBA tracts, other currently pending LBA tracts, and the existing federal leases, including previously leased LBA tracts, in the Wyoming PRB.

A separate document, entitled *Supplementary Information on the Affected Environment in the Combined Evaluation Area for the South Gillette Area Coal Lease Applications EIS*, has been prepared to provide detailed information on the affected environment in the general South Gillette analysis area. Copies of the supplementary information document are available on request and can be viewed at the BLM offices in Casper and Cheyenne.

1.1 Background

On July 6, 2004, RAG Coal West, Inc. (RAG) filed an application with BLM to lease federal coal reserves in a tract north of and immediately adjacent to the Belle Ayr Mine in Campbell County, Wyoming, approximately 10 miles south-southeast of Gillette, Wyoming (figure 1-1). The tract, originally referred to as the Belle Ayr Mine North Extension LBA tract, was assigned case file number WYW161248. The federal coal reserves were applied for as a maintenance tract for the Belle Ayr Mine. BLM subsequently renamed the tract the Belle Ayr North LBA tract.

In August 2004, RAG finalized the sale of the Belle Ayr Mine to Foundation Coal West (FCW), a directly held subsidiary of Foundation Coal Holdings, Inc. In this EIS, the applicant for the Belle Ayr North LBA tract will be referred to as FCW.

On February 10, 2006, Ark Land Company (ALC) filed an application with BLM to lease the federal coal reserves in a tract west of and immediately adjacent to the Coal Creek Mine in Campbell County, Wyoming, approximately 25 miles south-southeast of Gillette, Wyoming (figure 1-1). The tract, which is referred to as the West Coal Creek LBA tract, was assigned case number WYW172585. The federal

[1] Refer to page xxiii for a list of abbreviations and acronyms used in this document.

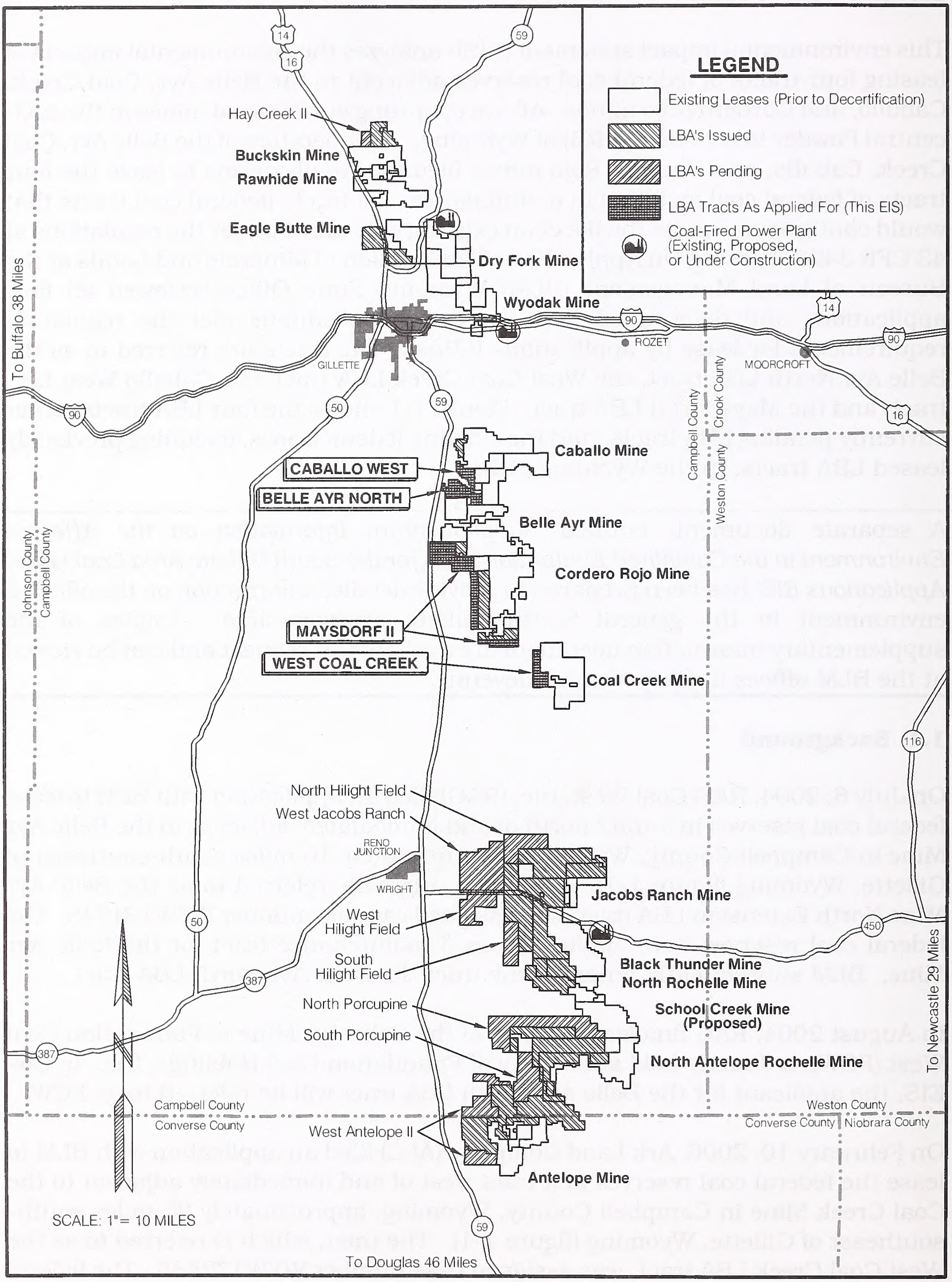


Figure 1-1. General Location Map with Federal Coal Leases and LBA Tracts.

coal reserves were applied for as a maintenance tract for the Coal Creek Mine. ALC is a wholly owned subsidiary of Arch Coal, Inc. Thunder Basin Coal Company (TBCC), a subsidiary of Arch Western Resources, LLC, operates the Coal Creek Mine. In this EIS, ALC is referred to as the applicant and TBCC is referred to in discussions of mine operations.

On March 15, 2006, Caballo Coal Company (CCC) filed an application with BLM to lease the federal coal included in a tract located west of and immediately adjacent to the Caballo Mine in Campbell County, Wyoming, approximately 8 miles south-southeast of Gillette, Wyoming (figure 1-1). The tract, which is referred to as the Caballo West LBA tract, was assigned case number WYW172657. The federal coal reserves were applied for as a maintenance tract for the Caballo Mine. CCC is a directly held subsidiary of Peabody Holding Company, Inc., which in turn is a directly held subsidiary of Peabody Energy Corporation.

On September 1, 2006, Cordero Mining Company (CMC) filed an application with BLM to lease the federal coal included in a tract west and south of and immediately adjacent to the Cordero Rojo Mine in Campbell County, Wyoming, approximately 15 miles south-southeast of Gillette, Wyoming (figure 1-1). The tract, which is referred to as the Maysdorf II LBA tract, was assigned case number WYW173360. The federal coal reserves were applied for as a maintenance tract for the Cordero Rojo Mine, which is operated by CMC, a directly held subsidiary of Rio Tinto Energy America (formerly Kennecott Energy and Coal Company).

These federal coal lands are located within the decertified Powder River federal coal region. The Powder River Regional Coal Team (PRRCT), a federal/state advisory board established to review coal lease applications in the Powder River federal coal region and to develop recommendations concerning management of federal coal in the Powder River Basin, reviewed the Belle Ayr North LBA tract at a public meeting held on April 24, 2005, in Gillette, Wyoming; the West Coal Creek and Caballo West LBA tracts were reviewed at a public meeting held on April 19, 2006, in Casper, Wyoming; and the Maysdorf II LBA tract was reviewed at a public meeting held on January 18, 2007, in Casper, Wyoming. The PRRCT recommended that BLM continue to process the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications at these respective meetings.

In order to process an LBA, BLM must evaluate the quantity, quality, maximum economic recovery, and fair market value of the federal coal and fulfill the requirements of National Environmental Policy Act of 1969 (NEPA) by evaluating the environmental impacts of leasing the federal coal. BLM does not authorize mining operations by issuing a lease, but the impacts of mining the coal are considered in this EIS because it is a logical consequence of issuing a maintenance lease to an existing mine. BLM determined that one EIS would be prepared to evaluate the environmental impacts that would be expected to occur if leases are issued for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts. This EIS has been prepared to evaluate the site-specific

and cumulative environmental impacts of leasing and developing the federal coal included in the four application areas. BLM will use the analysis in this EIS to decide whether to hold a competitive, sealed-bid lease sale for each tract as applied for, hold a competitive sealed-bid lease sale for a modified tract, or reject the current lease application and not offer the tract for sale at this time. A separate record of decision (ROD) will be issued for each LBA tract and, if the decision is to offer the tract for lease, a separate sale will be held for each tract. For each lease sale that is held, the bidding at the sale will be open to any qualified bidder; it will not be limited to the applicant.

For each lease sale that is held, a lease will be issued to the highest bidder if a federal panel determines that the high bid meets or exceeds the fair market value of the coal as determined by BLM's economic evaluation and if the United States (U.S.) Department of Justice determines that there will be no antitrust violations if a lease is issued to the high bidder.

Leasing of federal coal only grants the lessee the right to mine and sell the coal, with conditions for protection of the nonmineral interests associated with the federal coal. After a lease has been issued but prior to mine development, the lessee must file a permit application package with the Wyoming Department of Environmental Quality (WDEQ/LQD) and Office of Surface Mining Reclamation and Enforcement (OSM) for a surface mining permit and approval of the Mineral Leasing Act of 1920 (MLA) mining plan.

In return for receiving a lease, a lessee must pay the federal government a bonus equal to the amount it bids at the time the lease sale is held (the bonus can be paid in 5 yearly installments), make annual rental payments to the federal government, and make royalty payments to the federal government when the coal is mined. Prior to 2008, federal bonus, rental, and royalty payments were equally divided with the state in which the lease was located. However, for fiscal years 2008 and 2009, Congress decreased the state's royalty share to 48 percent, and increased the federal government's share to 52 percent. The percentage of federal bonus, rental, and royalty payments distribution will revert back to 50 percent/50 percent at the end of the 2009 fiscal year unless legislation is passed in the future to maintain or further modify the current percentage of distribution of royalties.

Other agencies may use this analysis to make decisions related to leasing and mining the federal coal in this tract. Federal, state, and local agencies may qualify as cooperating agencies because of "jurisdiction by law or special expertise" (40 CFR 1501.6, 1508.5). BLM invited potentially qualified agencies to participate as cooperating agencies in the preparation of the South Gillette Area Coal Lease Applications EIS. In response, OSM, WDEQ, and the Wyoming Department of Transportation (WYDOT)) are cooperating agencies on this EIS. OSM has primary responsibility to administer federal programs that regulate surface coal mining operations and will use this EIS to make decisions related to the approval of the MLA mining plan if the tract is leased. WDEQ has entered into a cooperative

agreement with the Secretary of the Interior to regulate surface coal mining operations on federal and nonfederal lands within the state of Wyoming. WYDOT's responsibilities include planning and supervising road improvement work, maintaining roads, and supporting airports and aviation in the state.

Since decertification of the Powder River Federal Coal Region in 1990, 20 federal coal leases have been sold at competitive sealed-bid sales and three exchanges of federal coal in the Wyoming portion of the Powder River federal coal region have been completed (table 1-1). This is the first application for a maintenance coal tract submitted by the Coal Creek and Caballo mines since decertification (table 1-1 and figure 1-1). The West Rocky Butte LBA, which is currently leased to the Caballo Mine, was originally leased to Northwestern Resources Co. The Belle Ayr Mine previously applied for the Belle Ayr LBA in 1997. The application was split into the Belle Ayr 1997 and Belle Ayr 2000 LBA tracts at the applicant's request. The Belle Ayr 2000 LBA tract was processed and offered for lease in 2001, but the bid was rejected as insufficient to meet fair market value. The applicant did not request that the Belle Ayr 2000 LBA tract be re-offered for sale but instead requested that the Belle Ayr 2000 LBA tract be recombined with the Belle Ayr 1997 LBA tract. BLM requested that the applicant update and resubmit the application for the Belle Ayr 1997 LBA tract and subsequently rejected the application when that did not occur. The Cordero Rojo Mine recently acquired the North and South Maysdorf LBA tracts. The Cordero Rojo Mine previously applied for the Maysdorf LBA in 2001 and subsequently amended the application in 2004. The application was split into the North and South Maysdorf LBA tracts during the NEPA process. These LBA tracts were processed and offered for lease in 2007, but the bids were rejected as insufficient to meet fair market value. Both tracts were re-offered for sale in 2008, with the bid for the South Maysdorf tract being accepted while the bid for the North Maysdorf tract was rejected for the second time. The North Maysdorf tract was offered for sale a third time in 2009 and the bid was accepted.

Table 1-2 summarizes the 12 lease applications that are currently pending.

1.1.1 Belle Ayr North LBA tract

The Belle Ayr North LBA tract as applied for and the existing federal coal leases associated with the adjacent Belle Ayr Mine are shown in figure 1-2. As applied for, this tract consists of a single block of federal coal and includes approximately 1,578.7 acres. FCW estimates that the Belle Ayr North LBA tract contains 208.0 million tons of in-place coal reserves. Not all of the coal included in the Belle Ayr North LBA tract is considered to be mineable at this time. The Bishop Road, a county road, overlies some of the coal included in the tract. The Surface Mining Control and Reclamation Act of 1977 (SMCRA) prohibits mining within 100 feet on either side of the right-of-way of any public road unless the appropriate public road authority allows the road to be relocated or closed after public notice, an opportunity for a public hearing, and a finding that the interests of the affected

Table 1-1. Leases Issued and Exchanges Completed Since Decertification, Powder River Basin, Wyoming.

Leases Issued

LBA Name (Lease Number) Applicant Mine Current Lessee Effective Date	Acres Leased[1]	Mineable Tons of Coal[1]	Successful Bid
Jacobs Ranch (WYW117924) Jacobs Ranch Mine Jacobs Ranch Coal Co. 10/1/1992	1,708.620	147,423,560	$20,114,930.00
West Black Thunder (WYW118907) Black Thunder Mine Thunder Basin Coal Co. 10/1/1992	3,492.495	429,048,216	$71,909,282.69
North Antelope/Rochelle (WYW119554) North Antelope & Rochelle Mines Powder River Coal Co. 10/1/1992	3,064.040	403,500,000	$86,987,765.00
West Rocky Butte (WYW122586) No Existing Mine[2] Caballo Coal Co. 1/1/1993	463.205	56,700,000	$16,500,000.00
Eagle Butte (WYW124783) Eagle Butte Mine Foundation Wyoming Land Co. 8/1/1995	1,059.180	166,400,000	$18,470,400.00
Antelope (WYW128322) Antelope Mine Antelope Coal Co. 2/1/1997	617.200	60,364,000	$9,054,600.00
North Rochelle (WYW127221) North Rochelle Mine Ark Land Co. 1/1/1998	1,481.930	157,610,000	$30,576,340.00
Powder River (WYW136142) North Antelope Rochelle Mine Powder River Coal Co. 9/1/1998	4,224.225	532,000,000	$109,596,500.00
Thundercloud (WYW136458) Jacobs Ranch Mine Thunder Basin Coal Co., LLC 1/1/1999	3,545.503	412,000,000	$158,000,008.50
Horse Creek (WYW141435) Antelope Mine Antelope Coal Co. 12/1/2000	2,818.695	275,577,000	$91,220,120.70
North Jacobs Ranch (WYW146744) Jacobs Ranch Mine Jacobs Ranch Coal Co. 5/1/2002	4,982.240	537,542,000	$379,504,652.00
NARO South (WYW154001) North Antelope Rochelle Mine BTU Western Resources, Inc. 9/1/2004	2,956.725	297,469,000	$274,117,684.00
West Hay Creek (WYW151634) Buckskin Mine Kiewit Mining Properties, Inc. 1/1/2005	921.158	142,698,000	$42,809,400.00

Table 1-1. Leases Issued and Exchanges Completed Since Decertification, Powder River Basin, Wyoming (Continued).

Leases Issued

LBA Name (Lease Number) Applicant Mine Current Lessee Effective Date	Acres Leased[1]	Mineable Tons of Coal[1]	Successful Bid
Little Thunder (WYW150318) Black Thunder Mine Ark Land LT Co. 3/1/2005	5,083.500	718,719,000	$610,999,949.80
West Antelope (WYW151643) Antelope Mine Antelope Coal Co. 3/1/2005	2,809.130	194,961,000	$146,311,000.00
NARO North (WYW150210) North Antelope Rochelle Mine BTU Western Resources, Inc. 3/1/2005	2,369.380	324,627,000	$299,143,785.00
West Roundup (WYW151134) North Rochelle Mine West Roundup Resources, Inc 5/1/2005	2,812.510	327,186,000	$317,697,610.00
Eagle Butte West (WYW155132) Eagle Butte Mine Foundation Wyoming Land Co. 5/1/2008	1,427.770	255,000,000	$180,540,000.00
South Maysdorf (WYW174407) Cordero Rojo Mine Cordero Mining Co. 8/1/2008	2,900.240	288,081,000	$250,800,000.00
North Maysdorf (WYW154432) Cordero Rojo Mine Cordero Mining Co. 1/29/2009	445.890	54,657,000	$48,098,424.00
TOTALS	**49,183.640**	**5,781,562,776**	**$3,162,452,451.69**

Exchanges Completed

Exchange Name Case File Number Exchange Proponent Exchange Type Effective Date	Acres Exchanged	Mineable Tons of Coal	Federal Coal Exchanged for:
EOG (Belco) I-90 Lease Exchange WYW150152 EOG Resources (formerly Belco)[3] I-90 Lease Exchanged for New Lease 4/1/2000	599.170	106,000,000	Lease Rights to Belco I-90 Lease (WYW0322794).
Pittsburg & Midway Coal Exchange WYW148816 Pittsburg and Midway Coal Mining Co. Private Land Exchanged for Federal Coal 1/27/2005	2,045.530	84,200,000	6,065.77 acres of land and some minerals in Lincoln, Carbon, and Sheridan Counties, Wyoming.
Gold Mine Draw Lease Exchange WYW0321779, WYW154001 Powder River Coal Co. AVF Lease Exchanged for New Lease 6/25/2006	623.000	47,700,000	Lease rights to 921.60 acres of leased federal coal underlying an AVF.
TOTALS	**3,267.700**	**237,900,000**	

[1] Information from sale notice.
[2] The West Rocky Butte LBA was originally leased to Northwestern Resources Co.
[3] The EOG Resources Belco Exchange lease is now owned by the Buckskin Mine.
Source: BLM Lease by Application Data Sheets (BLM 2009a).

Table 1-2. Pending LBAs and Exchanges, Powder River Basin, Wyoming.

Pending LBAs

LBA Name Lease Number Applicant Mine	Application Date	Acres as Applied for	Estimated as Applied for Coal (mmt)	Status
Belle Ayr North WYW161248 Belle Ayr Mine	7/6/2004	1,578.74	191.90 [3]	DEIS available 10/24/2008 Hearing 11/19/2008 FEIS in preparation
West Antelope II WYW163340 Antelope Mine	4/6/2005	4,108.60	429.70 [1]	FEIS available 12/19/2008 ROD in preparation
North Hilight Field WYW164812 Black Thunder Mine	10/7/2005	2,613.50	263.40 [3]	DEIS available June/2009 Hearing 7/29/2009 FEIS in preparation
South Hilight Field WYW174596 Black Thunder Mine	10/7/2005	1,976.69	213.60 [3]	DEIS available June/2009 Hearing 7/29/2009 FEIS in preparation
West Hilight Field WYW172388 Black Thunder Mine	1/17/2006	2,370.52	377.90 [3]	DEIS available June/2009 Hearing 7/29/2009 FEIS in preparation
West Coal Creek WYW172585 Coal Creek Mine	2/10/2006	1,151.26	57.00 [3]	DEIS available 10/24/2008 Hearing 11/19/2008 FEIS in preparation
Caballo West WYW172657 Caballo Mine	3/15/2006	777.49	81.80 [3]	DEIS available 10/24/2008 Hearing 11/19/2008 FEIS in preparation
West Jacobs Ranch WYW172685 Jacobs Ranch Mine	3/24/2006	5,944.37	669.60 [3]	DEIS available June/2009 Hearing 7/29/2009 FEIS in preparation
Hay Creek II WYW172684 Buckskin Mine	3/24/2006 Modified 5/19/2008 Modified 11/28/2008	419.04	77.20 [1]	DEIS in preparation Hearing 11/19/2008
Maysdorf II WYW173360 Cordero Rojo Mine	9/1/2006	4,653.84	474.50 [3]	DEIS available 10/24/2008 Hearing 11/19/2008 FEIS in preparation
North Porcupine WYW173408 North Antelope Rochelle Mine	9/29/2006 Modified 10/12/2007	5,795.78	601.20 [3]	DEIS available June/2009 Hearing 7/29/2009 FEIS in preparation
South Porcupine WYW176095 North Antelope Rochelle Mine	9/29/2006 Modified 10/12/2007	3,185.96	309.70 [3]	DEIS available June/2009 Hearing 7/29/2009 FEIS in preparation
TOTALS		**35,245.48**	**3,810.30**	

1 Estimated tons of in-place coal as reported in the lease application.
2 Estimated tons of mineable coal as reported in the lease application.
3 Estimated tons of recoverable coal as reported by the applicant.
Source: BLM Lease by Application Data Sheets (BLM 2009a).

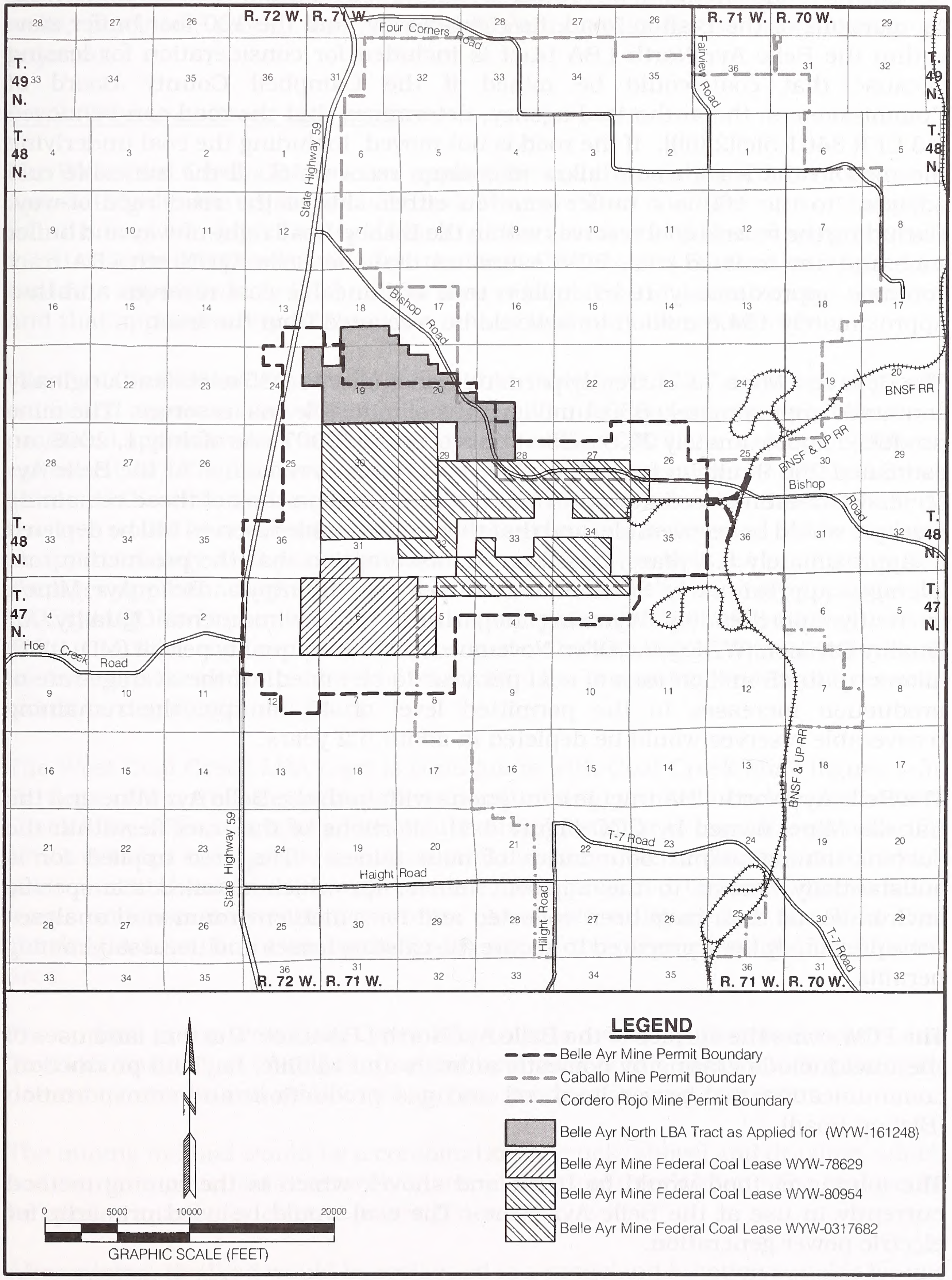


Figure 1-2. Belle Ayr Mine's Federal Coal Leases and Belle Ayr North LBA Tract as Applied for.

public and landowners will be protected [30 CFR 761.11(d)]. The coal underlying the portions of the Bishop Road, its right-of-way, and the 100-foot buffer zone within the Belle Ayr North LBA tract is included for consideration for leasing because that coal could be mined if the Campbell County Board of Commissioners, the authorized agency, determines that the road can be moved [43 CFR 3461.5(c)(2)(iii)]. If the road is not moved, including the coal underlying the road in the lease would allow maximum recovery of all the mineable coal adjacent to the 100-foot buffer zone on either side of the road right-of-way. Excluding the federal coal reserves within the Bishop Road right-of-way and buffer zone and any isolated coal, FCW estimates that the Belle Ayr North LBA tract contains approximately 164.7 million tons of mineable coal reserves and that approximately 154.8 million tons would be recovered from the tract.

The Belle Ayr Mine, as currently permitted, includes 11,935 acres and originally contained approximately 830.1 million tons of mineable coal reserves. The mine produced approximately 26.6 million tons of coal in 2007. As of July 1, 2008, an estimated 250.9 million tons of in-place coal reserves remained at the Belle Ayr Mine. FCW estimates that approximately 235.8 million tons of those remaining reserves would be recoverable, and that those recoverable reserves will be depleted in approximately 8.3 years, based on the assumption that the production rate averages approximately 30 million tons per year (mmtpy). Belle Ayr Mine's currently approved (by Wyoming Department of Environmental Quality/Air Quality Division [WDEQ/AQD] on November 7, 2006) air quality permit (MD-1476) allows up to 45 million tons of coal per year to be mined. If the average rate of production increases to the permitted level of 45 mmtpy, the remaining recoverable reserves would be depleted in about 5.2 years.

The Belle Ayr North LBA tract is contiguous with both the Belle Ayr Mine and the Caballo Mine, owned by CCC (figure 1-1). Portions of the tract lie within the current mining permit boundaries of both mines. The area applied for is substantially similar to the adjacent mines, for which detailed site-specific environmental data have been collected and for which environmental analyses have previously been prepared to secure the existing leases and necessary mining permits.

The FCW owns the surface of the Belle Ayr North LBA tract. Current land uses of the tract include grazing by domestic animals and wildlife, hayland production, communication and power lines, oil and gas production, and transportation (Bishop Road).

The mining method would be truck and shovel, which is the mining method currently in use at the Belle Ayr Mine. The coal would be used primarily for electric power generation.

After mining, the land would be reclaimed to a rangeland function suitable for use by livestock and wildlife, as is the current practice at the Belle Ayr Mine.

Industrial postmining land uses, which include, but are not limited to oil and gas wells, pipelines, roads, and utility easements, will also be reestablished as required.

1.1.2 West Coal Creek LBA tract

The West Coal Creek LBA tract as applied for and the existing federal coal leases associated with the adjacent Coal Creek Mine are shown in figure 1-3. As applied for, this tract consists of a single block of federal coal and includes approximately 1,151.3 acres. ALC estimates that the West Coal Creek LBA tract as applied for contains approximately 63.3 million tons of in-place and mineable coal reserves; and that approximately 57.0 million tons of that coal are recoverable.

The Coal Creek Mine, as currently permitted, includes 9,722.7 acres and originally contained approximately 318.2 million tons of mineable coal reserves. The mine produced approximately 10.2 million tons of coal in 2007. As of July 1, 2008, an estimated 241.7 million tons of in-place coal reserves remained at the Coal Creek Mine. ALC estimates that approximately 217.5 million tons of those remaining reserves would be recoverable and that those recoverable reserves will be depleted in approximately 16.2 years, based on the assumption that the production rate averages approximately 13.4 mmtpy. Coal Creek Mine's currently approved (by WDEQ/AQD on September 2, 2008) air quality permit (MD-5393) allows up to 50 million tons of coal per year to be mined. If the average rate of production increases to the permitted level of 50 mmtpy, the remaining recoverable reserves would be depleted in 4.8 years.

The West Coal Creek LBA tract is contiguous with Coal Creek Mine (figure 1-3). Portions of the tract lie within the current mining permit boundary of the Coal Creek Mine. The area applied for is substantially similar to the adjacent mine, for which detailed site-specific environmental data have been collected and for which environmental analyses have previously been prepared to secure the existing leases and necessary mining permits. As shown in figure 1-1, the West Coal Creek LBA tract is not contiguous with any of the other existing mines in this area.

The surface of the West Coal Creek LBA tract is owned by Dennis Edwards and Thunder Basin Coal Co., LLC. Current land uses of the tract include grazing by domestic animals and wildlife, oil and gas production, and recreation.

The mining method would be a combination of truck/shovel and dragline, which are the mining methods currently in use at the Coal Creek Mine. The coal would be used primarily for electric power generation.

After mining, the land would be reclaimed to a rangeland function suitable for use by livestock and wildlife, as is the current practice at the Coal Creek Mine. Industrial postmining land uses, which include, but are not limited to oil and

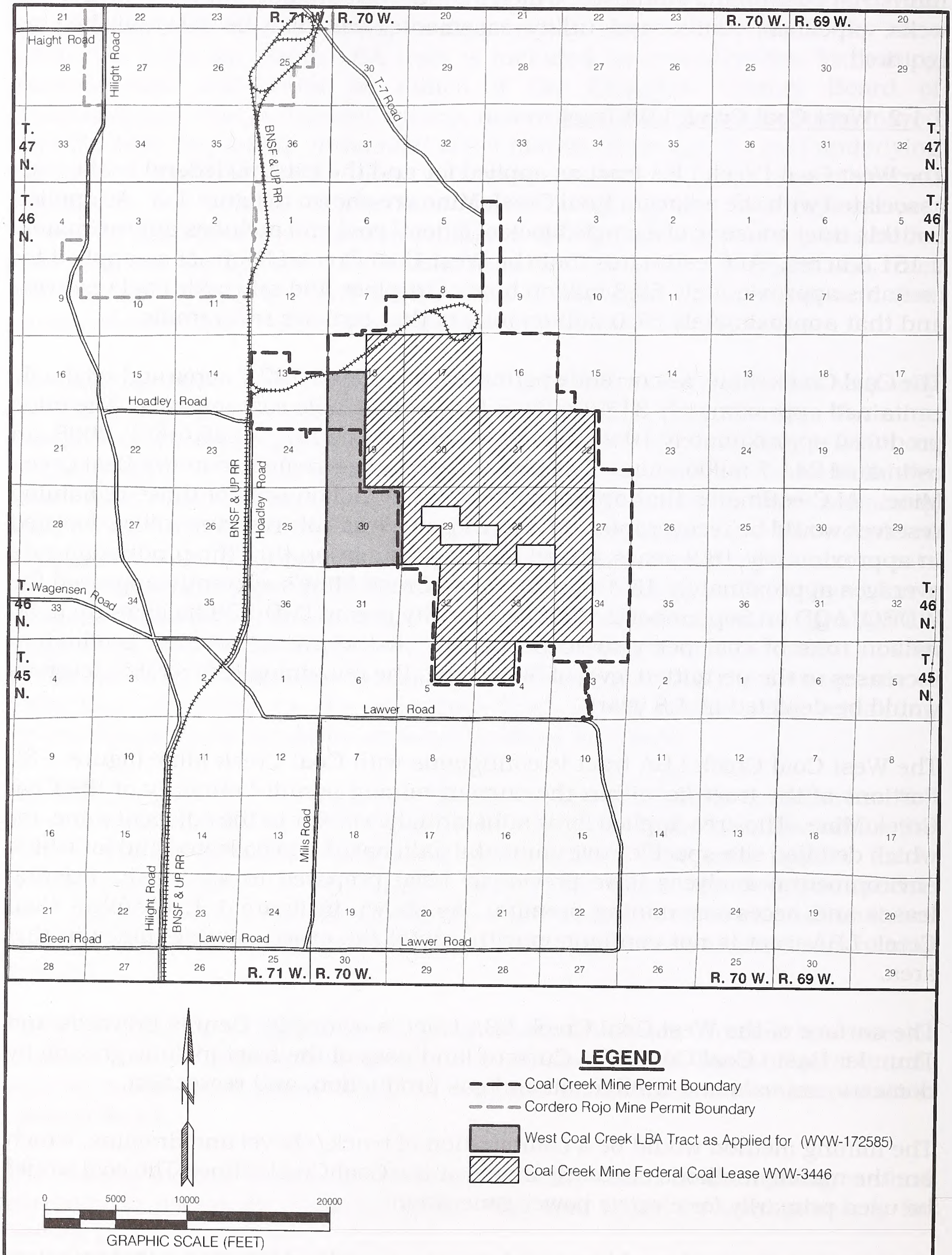


Figure 1-3. Coal Creek Mine's Federal Coal Leases and West Coal Creek LBA Tract as Applied for.

gas wells, pipelines, roads, and utility easements, will also be reestablished as required.

1.1.3 Caballo West LBA tract

The Caballo West LBA tract as applied for and the existing federal coal leases associated with the adjacent Caballo Mine are shown in figure 1-4. As applied for, this tract consists of a single block of federal coal and includes approximately 777.5 acres. CCC estimates that the Caballo West LBA tract as applied for contains approximately 98.2 million tons of in-place coal reserves, of which about 87.5 million tons of coal reserves are mineable and approximately 81.8 million tons of coal reserves are recoverable.

The Caballo Mine, as currently permitted, includes 19,974.7 acres and originally contained approximately 1,286.6 million tons of mineable coal reserves. The Caballo Mine produced approximately 31.2 million tons of coal in 2007. As of July 1, 2008, an estimated 893.7 million tons of in-place coal reserves remained at the Caballo Mine. CCC estimates that approximately 584.8 million tons of those remaining reserves are recoverable and that those recoverable reserves will be depleted in approximately 15.4 years, based on the assumption that the production rate averages approximately 37.8 mmtpy. Caballo Mine's currently approved (by WDEQ/AQD on November 7, 2006) air quality permit (MD1477) allows up to 50 million tons of coal per year to be mined. If the average rate of production increases to the permitted level of 50 mmtpy, the remaining recoverable reserves would be depleted in about 11.7 years.

The Caballo West LBA tract is contiguous with both the Caballo Mine and the Belle Ayr Mine, owned by FCW (figure 1-1). Portions of the tract lie within the current mining permit boundary of the Caballo Mine. The area applied for is substantially similar to the adjacent mines, for which detailed site-specific environmental data have been collected and for which environmental analyses have previously been prepared to secure the existing leases and necessary mining permits.

The surface of the Caballo West LBA tract is owned by the Paul D. Rourke Trust; James F. Rourke, et al.; and FCW. Current land uses of the tract include grazing by domestic animals and wildlife, recreation, agricultural activities, transportation (Bishop Road), and oil and gas production.

The mining method would be a combination of truck/shovel and dragline. This would be an operational change since a dragline is not currently in use at the Caballo mine. The coal would be used primarily for electric power generation.

After mining, the land would be reclaimed to a rangeland function suitable for use by livestock and wildlife, as is the current practice at the Caballo Mine. Industrial

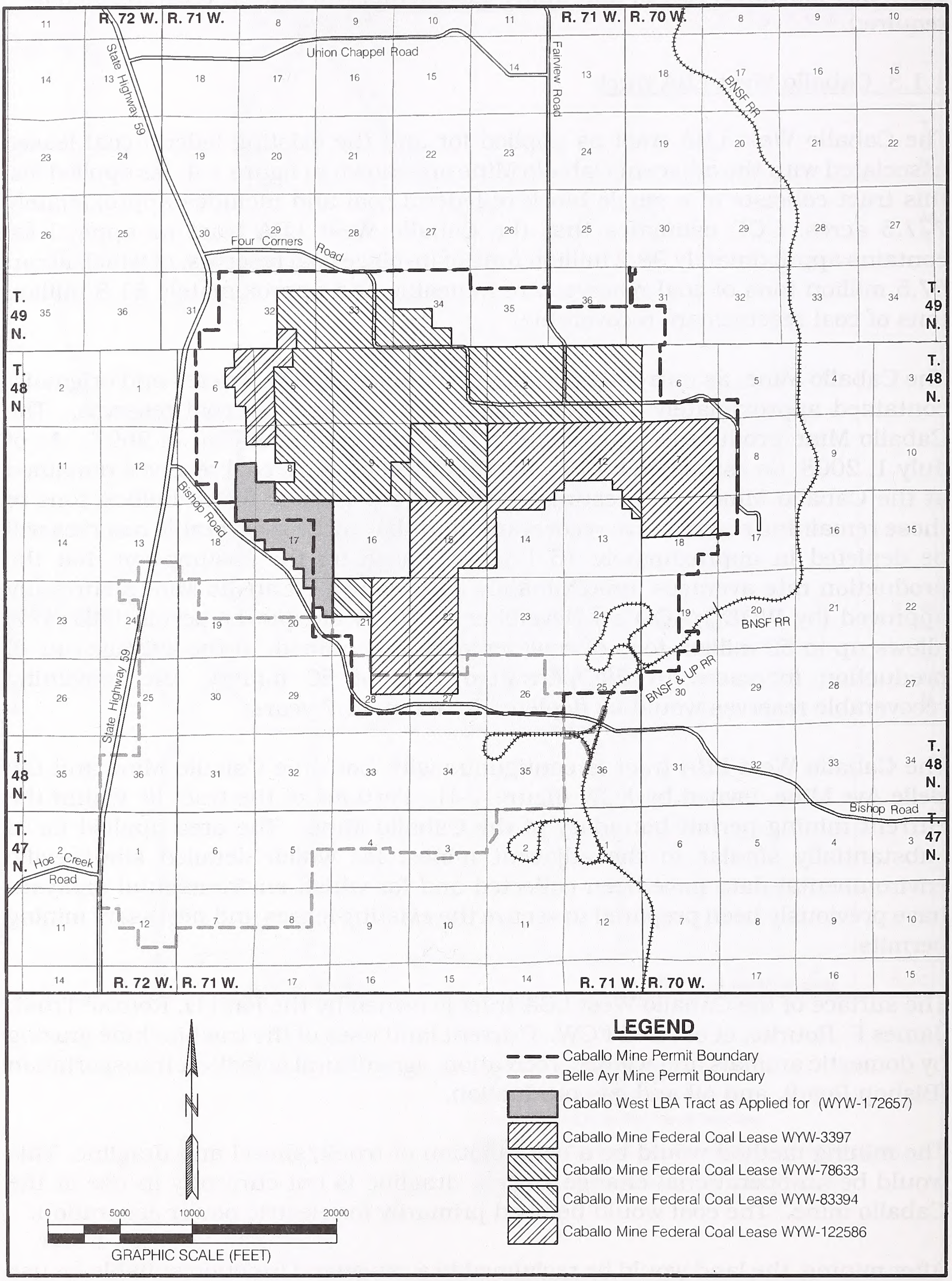


Figure 1-4. Caballo Mine's Federal Coal Leases and Caballo West LBA Tract as Applied for.

postmining land uses, which include but are not limited to oil and gas wells, pipelines, roads, and utility easements, will also be reestablished as required.

1.1.4 Maysdorf II LBA tract

The Maysdorf II LBA tract as applied for and the existing federal coal leases associated with the adjacent Cordero Rojo Mine are shown in figure 1-5. As applied for, this tract consists of two separate blocks of federal coal and includes approximately 4,653.8 acres. CMC estimates that the tract contains approximately 504 million tons of in-place coal reserves. Not all of the coal included in the Maysdorf II LBA tract is considered by CMC to be mineable at this time. Approximately 1.6 million tons of the coal included in the tract are located within the BNSF & UP railroad right-of-way (ROW). CMC does not consider the coal underlying the ROW to be recoverable at this time because the cost that would be associated with moving the railroad would make it economically unfeasible to recover the underlying coal.

A portion of Wyoming 59 and portions of the Haight Road (Campbell County Road 44) and the Hilight Road (Campbell County Road 52) overlie portions of the coal included in the tract. Surface Mining Control and Reclamation Act of 1977 (SMCRA) prohibits mining within 100 feet on either side of the ROW of any public road unless the appropriate public road authority allows the road to be relocated or closed after public notice, an opportunity for a public hearing, and a finding that the interests of the affected public and landowners will be protected [30 CFR 761.11(d)]. The coal underlying the portion of Wyoming 59, Hilight Road, and Haight Road, their rights-of-way, and the 100-foot buffer zones within the Maysdorf II LBA tract are included for consideration for leasing because that coal could be mined if WYDOT and/or the Campbell County Board of Commissioners, the authorized agencies, determine that the roads can be moved [43 CFR 3461.5(c)(2)(iii)]. If the highway and Haight and Hilight roads are not moved, including the coal underlying the highway and these roads in the lease would allow maximum recovery of all the mineable coal adjacent to the 100-foot buffer zones on either side of the highway and road ROWs. CMC estimates that approximately 3.0 million tons of mineable coal are included within the right-of-way of Wyoming 59 and associated 100-foot buffer zone that is within the LBA tract. There are currently no proposals by either the applicant or WYDOT to move the road. CMC estimates that approximately 17 million tons of mineable coal are included within the rights-of-way of the Haight and Hilight roads and associated 100-foot buffer zones that are within the LBA tract. CMC is evaluating the feasibility of relocating the county roads.

A small portion of the Maysdorf II tract is located within a "no-coal" zone, where coal-forming sediments were either not deposited or were eroded away after deposition.

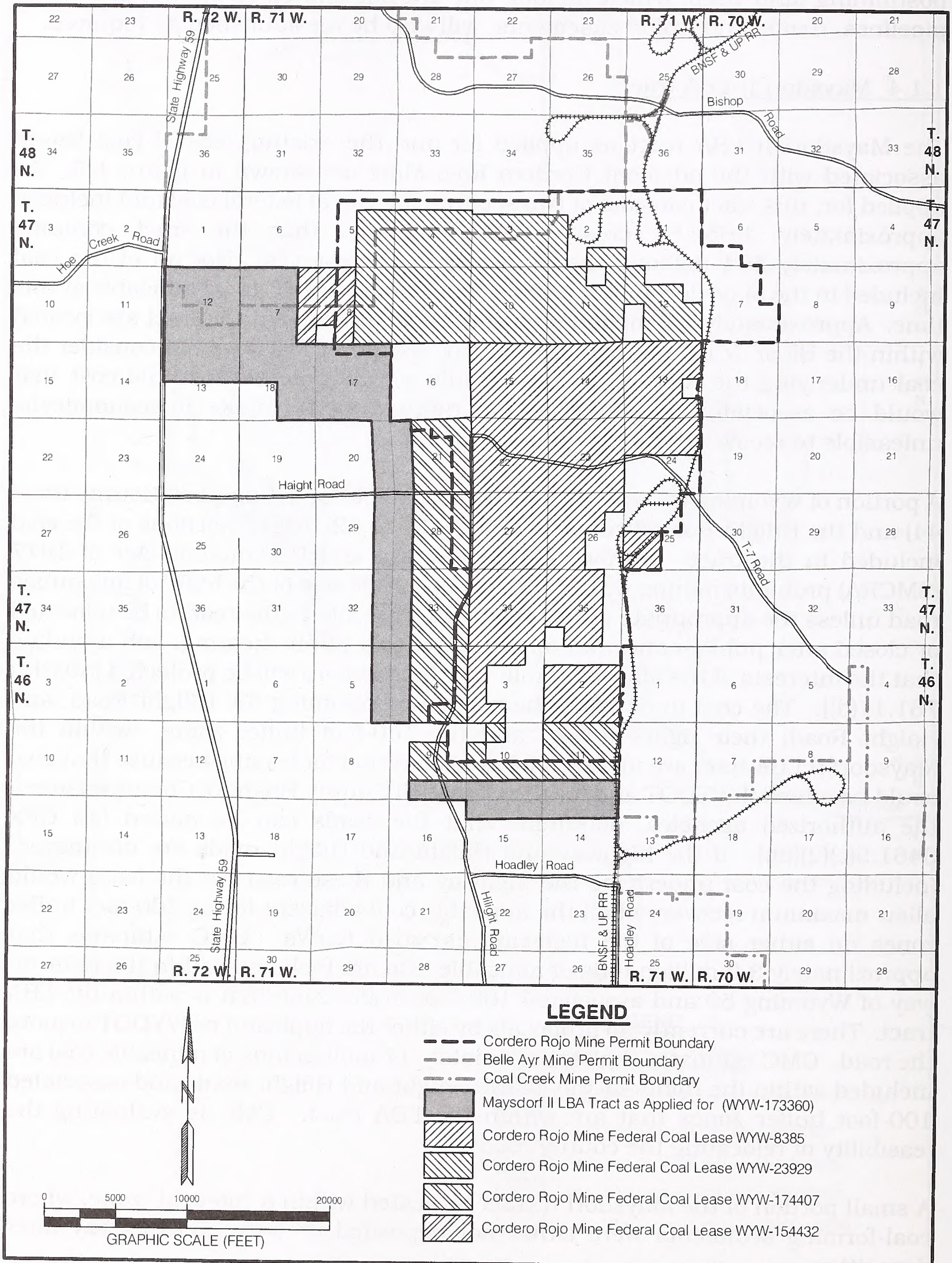


Figure 1-5. Cordero Rojo Mine's Federal Coal Leases and Maysdorf II LBA Tract as Applied for.

Excluding the federal coal reserves within the railroad right-of-way and the highway and county road rights-of-way and buffer zones, and taking into account the no-coal zone, CMC estimates that the Maysdorf II LBA tract as applied for contains approximately 482.5 million tons of mineable coal reserves and approximately 434.3 million tons of recoverable coal reserves.

The Cordero Rojo Mine is comprised of the former Cordero Mine and the contiguous former Caballo Rojo Mine. Rio Tinto Energy America, the parent company of CMC (the operator of the former Cordero Mine), purchased 100 percent of the stock of Caballo Rojo Inc. (CRI) (the operator of the former Caballo Rojo Mine) on February 19, 1997. The Cordero Mine originally included 8,517 acres and contained approximately 593 million tons of mineable coal reserves. The Caballo Rojo Mine originally included 7,664 acres containing approximately 493 million tons of mineable coal reserves. Cordero Rojo Mine personnel recently worked with the WDEQ/LQD to consolidate the CMC and CRI mining permits into a single mining permit (237-T8) for the Cordero Rojo Mine, which includes approximately 16,910.6 acres. The Cordero Rojo Mine produced approximately 40.5 million tons of coal in 2007. As of July 1, 2008, an estimated 572.9 million tons of in-place coal reserves remained at the Cordero Rojo Mine. CMC estimates that approximately 525.9 million tons of the mine's remaining reserves would be recoverable, and that those recoverable reserves will be depleted in nearly 11.4 years, based on the assumption that the production rate averages approximately 46.3 mmtpy. Cordero Rojo Mine's currently approved (by WDEQ/AQD on September 17, 2004) air quality permit (MD-1058) allows up to 65 million tons of coal per year to be mined. If the average rate of production increases to the permitted level of 65 mmtpy, the remaining recoverable reserves would be depleted in about 8.1 years.

As discussed above, the Maysdorf II LBA tract as applied for consists of two separate blocks. The northern block is contiguous with both the Cordero Rojo Mine and the Belle Ayr Mine, owned by FCW (figure 1-1). Portions of the northern block lie within the current mining permit boundaries of both mines. The southern block is contiguous with both the Cordero Rojo Mine and the Coal Creek Mine, owned by ALC (figure 1-1). Portions of the southern block lie within the current mining permit boundary of the Cordero Rojo Mine. The area applied for is substantially similar to the adjacent mine, for which detailed site-specific environmental data have been collected and for which environmental analyses have previously been prepared to secure the existing leases and necessary mining permits.

The surface of the Maysdorf II LBA tract is owned by the United States of America; CMC; CRI; the Norma Duvall Trust; Earl Thrush, et al.; Western Railroad Properties, Inc.; Tony Hayden; Keidel Family LP; and Foundation Wyoming Land Company. The federally owned surface is administered by BLM. Current land uses of the tract include grazing by domestic animals and wildlife, agricultural

activities, transportation (Hilight and Haight roads and the BNSF & UP tracks), and oil and gas production. See section 3.11 for additional land use discussion.

The mining method would be a combination of truck/shovel and dragline, which are the mining methods currently in use at the Cordero Rojo mine. The coal would be used primarily for electric power generation.

After mining, the land would be reclaimed to a rangeland function suitable for use by livestock and wildlife, as is the current practice at the Cordero Rojo Mine. Industrial postmining land uses, which include, but are not limited to oil and gas wells, pipelines, roads, and utility easements, will also be reestablished as required.

1.2 Purpose and Need for Action

BLM administers the federal coal leasing program under the Mineral Leasing Act of 1920. A federal coal lease grants the lessee the exclusive right to obtain a mining permit, which would allow coal mining on the leased tract, subject to the terms of the lease, the mining permit, and applicable state and federal laws. Before a new lease can be mined, the lessee must obtain approval of a detailed permit to conduct mining operations.

This EIS is being prepared in response to applications BLM received from the operators of the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines, four existing mines, to lease four tracts of federal coal in the Wyoming PRB. In response to each application, BLM must decide whether to hold a competitive, sealed-bid lease sale for a tract as applied for, hold a competitive sealed-bid lease sale for a modified tract, or reject a current lease application and not offer the tract for sale at this time.

FCW has applied for the coal reserves in the Belle Ayr North LBA tract in order to extend the life of the Belle Ayr Mine. Mining operations at the Belle Ayr Mine would be extended for about 6.4 additional years if FCW acquires a lease for the Belle Ayr North LBA tract and the average production rate at the Belle Ayr Mine is 30 mmtpy. At the permitted production level of 45 mmtpy, mining operations would be extended by about 3.5 years if FCW acquires a lease for the North Belle Ayr North LBA tract. There would be additional production extension if the Bishop Road is moved and the underlying and isolated coal is mined.

ALC has applied for the coal reserves in the West Coal Creek LBA tract in order to extend the life of the Coal Creek Mine. Mining operations at the West Coal Creek Mine would be extended for about 4.3 additional years if ALC acquires a lease for the West Coal Creek LBA tract and the average production rate at the Coal Creek Mine is 13.4 mmtpy. At the permitted production level of 50 mmtpy, mining operations would be extended by about 1.1 years if ALC acquires a lease for the West Coal Creek LBA tract.

CCC has applied for the coal reserves in the Caballo West LBA tract in order to extend the life of the Caballo Mine. Mining operations at the Caballo Mine would be extended for about 2.2 additional years if CCC acquires a lease for the Caballo West LBA tract and the average production rate at the Caballo Mine is 37.8 mmtpy. At the permitted production level of 50 mmtpy, mining operations would be extended by about 1.6 years if CCC acquires a lease for the Caballo West LBA tract.

CMC has applied for the coal reserves in the Maysdorf II LBA tract in order to extend the life of the Cordero Rojo Mine. Mining operations at the Cordero Rojo Mine would be extended for about 9.4 additional years if CMC acquires a lease for the Maysdorf II LBA tract, the coal underlying Wyoming 59 and the Haight and Hilight county roads is not mined, and the average production rate at the Cordero Rojo Mine is 46.3 mmtpy. At the permitted production level of 65 mmtpy, mining operations would be extended by about 6.7 years if CMC acquires a lease for the Maysdorf II LBA tract. There would be a slight additional production extension if the Haight and Hilight county roads are moved and the underlying coal is mined. CMC applied for additional federal coal reserves (the North and South Maysdorf LBA tracts) in 2001 (table 1-1). BLM estimates that the North Maysdorf LBA tract includes approximately 54.7 million tons of mineable coal and that the South Maysdorf LBA tract includes approximately 288 million tons of mineable coal.

If an LBA tract is leased to the applicant as a maintenance tract, the permit to conduct mining operations for the adjacent mine would have to be amended to include the new lease area before it could be disturbed. This process takes several years to complete. FCW, ALC, CCC, and CMC are applying for federal coal reserves now so that they can complete the permitting process in time to mine the new federal reserves in a logical progression as existing reserves are depleted.

As discussed above, the purpose of the four applications is to allow the applicant mines access to a continuing supply of low sulfur compliance coal which would be mined and sold to power plants for the purpose of electric power generation. According to the U.S. Department of Energy, coal demand is driven by the electric power sector, which accounts for about 92 percent of consumption. Approximately 50 percent of the electric power in the U.S. was provided by coal in 2005 and 2006 (USDOE 2007a). Continued leasing of PRB coal enables coal-fired power plants to meet the Clean Air Act (CAA) requirements without constructing new plants, revamping existing plants, or switching to existing alternative fuels. This helps provide a stable supply of power to meet increasing demand without a potentially significant increase in power costs for individuals and businesses.

A primary goal of the National Energy Policy is to add energy supplies from diverse sources, including domestic oil, gas, and coal, as well as hydropower and nuclear power. BLM recognizes that the continued extraction of coal is essential to meet the nation's future energy needs. As a result, private development of federal coal reserves is integral to the BLM coal leasing program under the authority of the

Mineral Leasing Act of 1920 (MLA), as well as Federal Land Policy Management Act of 1976 (FLPMA) and Federal Coal Leasing Act Amendments of 1976 (FCLAA). The coal leasing program, managed by BLM, encourages the development of domestic coal reserves and reduction of the U.S. dependence on foreign sources of energy. As a result of the leasing and subsequent mining and sale of federal coal resources in the PRB, the public receives lease bonus, rental, and royalty payments, and a reliable supply of low sulfur coal for power generation.

This EIS analyzes the environmental impacts of issuing federal coal leases and mining the federal coal in the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II maintenance coal lease application tracts as required by NEPA and associated rules and guidelines. A decision to hold a competitive sale and issue a lease for the lands in any of these applications is a prerequisite for mining but it is not the enabling action that would allow mining to begin. BLM does not authorize mining operations by issuing a lease. After a lease has been issued but prior to mine development, the lessee must file a permit application package with the WDEQ/LQD and OSM for a surface mining permit and approval of the MLA mining plan. An analysis of a detailed site-specific mining and reclamation plan occurs at that time. Authorities and responsibilities of BLM and other concerned regulatory agencies are described in the following sections.

1.3 Regulatory Authority and Responsibility

The Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II maintenance coal lease applications were submitted and will be processed and evaluated under the following federal authorities:

- Mineral Leasing Act of 1920, as amended;
- Multiple-Use Sustained Yield Act of 1960;
- National Environmental Policy Act of 1969;
- Federal Coal Leasing Act Amendments of 1976;
- Federal Land Policy Management Act of 1976; and
- Surface Mining Control and Reclamation Act of 1977.

BLM is the lead agency responsible for leasing federal coal lands under the Mineral Leasing Act as amended by Federal Coal Leasing Act Amendments and is also responsible for preparation of this EIS to evaluate the potential environmental impacts of issuing each coal lease.

OSM is a cooperating agency on this EIS. After a federal coal lease is issued, SMCRA gives OSM primary responsibility to administer programs that regulate surface coal mining operations and the surface effects of underground coal mining operations. WDEQ is also a cooperating agency on this EIS. Pursuant to Section 503 of SMCRA, the WDEQ developed, and in November 1980 the Secretary of the Interior approved, a permanent program authorizing WDEQ to regulate surface coal mining operations and surface effects of underground mining on non-federal

lands within the state of Wyoming. In January 1987, pursuant to Section 523(c) of SMCRA, WDEQ entered into a cooperative agreement with the Secretary of the Interior authorizing WDEQ to regulate surface coal mining operations and surface effects of underground mining on federal lands within the state.

Pursuant to the cooperative agreement, a federal coal lease holder in Wyoming must submit a permit application package to OSM and WDEQ/LQD for any proposed coal mining and reclamation operations on federal lands in the state. WDEQ/LQD reviews the permit application package to insure the permit application complies with the permitting requirements and the coal mining operation will meet the performance standards of the approved Wyoming program. OSM, BLM, and other federal agencies review the permit application package to insure it complies with the terms of the coal lease, the MLA, NEPA, and other federal laws and their attendant regulations. If the permit application package does comply, WDEQ issues the applicant a permit to conduct coal mining operations. OSM recommends approval, approval with conditions, or disapproval of the MLA mining plan to the Assistant Secretary of the Interior, Land and Minerals Management. Before the MLA mining plan can be approved, BLM must concur with this recommendation.

If a proposed LBA tract is leased to an existing mine, the lessee is required to revise its coal mining permit prior to mining the newly-leased coal, following the processes outlined above. As a part of that process, a detailed new plan would be developed showing how the newly-leased lands would be mined and reclaimed. The area of mining disturbance would be larger than the newly leased area to allow for activities such as overstripping, matching reclaimed topography to undisturbed topography, constructing flood control and sediment control facilities, and related activities. Specific impacts that would occur during the mining and reclamation of the LBA tract would be addressed in the mining and reclamation plan, and specific mitigation measures for anticipated impacts would be described in detail at that time.

WDEQ enforces the performance standards and permit requirements for reclamation during a mine's operation and has primary authority in environmental emergencies. OSM retains oversight responsibility for this enforcement. Where federal surface or coal resources are involved, BLM has authority in emergency situations if WDEQ or OSM cannot act before environmental harm and damage occurs. In preparing this EIS, BLM also has a responsibility to consult with and obtain the comments and assistance of other state and federal agencies that have jurisdiction by law or special expertise with respect to potential environmental impacts.

Appendix A presents other federal and state permitting requirements that must be satisfied to mine these LBA tracts.

1.4 Relationship to BLM Policies, Plans, and Programs

In addition to the federal acts listed under section 1.3, guidance and regulations for managing and administering public lands, including the federal coal lands included in the FCW, ALC, CCC, and CMC applications, are set forth in 40 CFR 1500 (Protection of Environment), 43 CFR 1601 (Planning, Programming, Budgeting), and 43 CFR 3400 (Coal Management).

Specific guidance for processing applications is provided by BLM Manual 3420, Competitive Coal Leasing (BLM 1989) and the 1991 *Powder River Regional Coal Team Operational Guidelines For Coal Lease-By-Applications* (BLM 1991). The *National Environmental Policy Act Handbook* (BLM 2008a) has been followed in developing this EIS.

1.5 Conformance with Existing Land Use Plans

Federal Coal Leasing Act Amendments requires that lands considered for leasing be included in a comprehensive land use plan and that leasing decisions be compatible with that plan. The BLM *Approved Resource Management Plan for Public Lands Administered by the Bureau of Land Management Buffalo Field Office* (BLM 2001a), an update of the *Buffalo Resource Area Resource Management Plan* (BLM 1985), governs and addresses the leasing of federal coal in Campbell County.

The major land use planning decision that BLM must make concerning the federal coal resources is a determination of which federal coal lands are acceptable for further consideration for leasing. BLM uses four screening procedures to identify these coal lands. These screening procedures require BLM to:

- estimate development potential of the coal lands;
- apply the Unsuitability Criteria listed in the regulations at 43 CFR 3461;
- make multiple land use decisions that eliminate federal coal deposits from consideration for leasing to protect other resource values; and
- consult with surface owners who meet the criteria defined in the regulations at 43 CFR 3400.0-5(gg)(1) and (2).

Only those federal coal lands that pass these screens are considered for leasing. BLM has applied these coal screens to federal coal lands in the Wyoming PRB several times, starting in the early 1980s. Most recently, in 1993, BLM began the process of reapplying these screens to federal coal lands in Campbell, Converse, and Sheridan counties. This analysis was adopted in the 2001 BLM Buffalo Field Office RMP update (BLM 2001a) and the results were included as appendix D of the update, which can be viewed in the 2001 NEPA documents section on the Wyoming BLM website at http://www.wy.blm.gov/wy/st/en/info/nepa/documents.html.

Under the first coal screening procedure, a coal tract must be located within an area that has been determined to have coal development potential in order to be acceptable for further consideration for leasing [43 CFR 3420.1-4(e)(1)]. The Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications are within the area identified by the BLM as having coal development potential in the coal screening analyses published in the 2001 BLM Buffalo Field Office RMP update.

The second coal screening procedure requires the application of the coal mining unsuitability criteria listed in the federal coal management regulations at 43 CFR 3461. The coal mining unsuitability criteria were applied to high to moderate coal development potential lands in the Wyoming PRB, including the four LBA tracts and surrounding lands during the coal screening conducted for the Buffalo RMP update. No lands included in the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts were determined to be unsuitable for mining during the application of the unsuitability criteria for the 2001 RMP update; however, site-specific unsuitability determinations for some criteria were deferred until an application to lease was filed.

Appendix B of this EIS summarizes the unsuitability criteria, describes the general findings for the Buffalo RMP update, and presents a validation of these findings for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts.

Unsuitability Criterion 3 states that lands within 100 feet of the outside line of the ROW of a public road shall be considered unsuitable for surface coal mining, with certain exceptions. One of the exceptions to this criterion allows surface coal mining in the ROW and buffer zone for a public road if the regulatory authority (or the appropriate public road authority designated by the regulatory authority) allows the public road to be relocated or closed after providing public notice and opportunity for a public hearing, and finding in writing that the interests of the affected public and landowners will be protected [30 CFR 761.11(d) and 43 CFR 3461.5(c)(2)(iii)].

As discussed in section 1.1 and shown in figure 1-2, a portion of the Bishop Road crosses the northern edge of the Belle Ayr North LBA tract. The 2001 Buffalo RMP update deferred a decision on the unsuitability of public roads, such as the Bishop Road and the associated buffer zones, until a leasing action occurred, with the assumption that the exception discussed above would be applicable. BLM has determined that the portions of the Belle Ayr North LBA tract that includes the Bishop Road, its ROW, and a 100-foot buffer zone must be considered unsuitable for mining under Unsuitability Criterion 3 at this time.

Although land within the Bishop Road ROW is now determined to be unsuitable for mining, it is included in the Belle Ayr North LBA tract. FCW is currently evaluating the feasibility of relocating the Bishop Road if they lease the Belle Ayr

North LBA tract. No plan has been formulated, and the Campbell County Board of Commissioner has not approved road relocation; therefore the unsuitability designation related to the Bishop Road ROW remains in place. However, including this land in the Belle Ayr North LBA tract would allow recovery of all the mineable coal adjacent to and outside of the road buffer zone and would comply with the coal leasing regulations, which do not allow leasing in less than 10-acre aliquot parts. Stipulations stating that no mining activity may be conducted within 100 feet of the Bishop Road ROW until a permit to move the road is approved will be attached if a lease is issued for the Belle Ayr North LBA tract. The exclusion of the coal underlying the road ROW and associated buffer zone from mining activity by lease stipulation honors the finding of unsuitability for mining under Unsuitability Criterion Number 3 for the Bishop Road.

As discussed in section 1.1 and shown in figure 1-5, a portion of Wyoming 59 crosses the western edge of the northern block of the Maysdorf II LBA tract and the Haight and Hilight county roads cross portions of the southern block. The 2001 Buffalo RMP update deferred a decision on the unsuitability of public roads until a leasing action occurred, with the assumption that the exception discussed above would be applicable. At this time, CMC does not have plans to relocate the highway and the exception does not apply. CMC is evaluating the feasibility of relocating the county roads but no plans have been formulated and the Campbell County Board of Commissioner has not approved the road relocations. As a result, BLM has determined that the portions of the Maysdorf II LBA tract that includes Wyoming 59, its ROW, and a 100-foot buffer zone on the east side of the ROW and the Haight and Hilight county roads, their rights-of-way, and 100-foot buffers must be considered unsuitable for mining under Unsuitability Criterion 3 at this time.

Although lands within the Wyoming 59, the Haight Road, and Hilight Road rights-of-way and their associated buffer zones are now determined to be unsuitable for mining, they are included in the Maysdorf II LBA tract. CMC is evaluating the feasibility of relocating the county roads but no plans have been formulated and the Campbell County Board of Commissioner has not approved the relocation of the roads. CMC does not currently have plans to relocate the highway if it leases the Maysdorf II LBA tract; therefore the unsuitability designations related to the highway and county road rights-of-way remain in place. However, including these lands in the Maysdorf II LBA tract would allow recovery of all the mineable coal adjacent to and outside of the zones and would comply with the coal leasing regulations, which do not allow leasing in less than 10-acre aliquot parts. If permits to relocate the county roads are approved, including the lands in the tract would allow recovery of the coal underlying the roads and associated buffer zones. Stipulations stating that no mining activity may be conducted within 100 feet of the road rights-of-way until permits to move the roads are approved will be attached if a lease is issued for the Maysdorf II Tract. The exclusion of the coal underlying the road rights-of-way and associated buffer zones from mining activity

by lease stipulation honors the finding of unsuitability for mining under Unsuitability Criterion 3 for Wyoming 59 and the Haight and the Hilight roads.

The third coal screening procedure, a multiple land use conflict analysis, must be completed to identify and "eliminate additional coal deposits from further consideration for leasing to protect resource values of a locally important or unique nature not included in the unsuitability criteria," in accordance with 43 CFR 3420.1-4(e)(3). The 2001 Buffalo RMP update addresses two types of multiple land use conflicts: municipal/residential conflicts and multiple mineral development (coal versus oil and gas) conflicts.

The municipal/residential multiple land use conflict was addressed in the 1985 Buffalo RMP by applying buffers around the municipal planning boundaries for the major municipalities within the BLM Buffalo Field Office area, including Gillette. The Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts do not lie within or near an identified buffer zone surrounding an existing community. Therefore, no federal coal lands within the four LBA tracts have been eliminated from further consideration for leasing due to municipal/residential conflicts.

The 2001 Buffalo RMP includes two decisions related to multiple mineral development conflicts in Campbell, Converse, and Sheridan counties. With respect to oil and gas leasing in coal mining areas, the RMP update determines that oil and gas tracts that would interfere with coal mining operations would not be offered for lease but that, where possible, oil and gas leases will be issued with specific conditions to prevent a development conflict with coal mining operations. With respect to coal leasing in oil and gas fields, the 2001 Buffalo RMP update states that coal leasing in producing oil and gas fields would be deferred unless or until coal development would not interfere with the economic recovery of the oil and gas resources, as determined on a case-by-case basis.

Both conventional and coal bed natural gas (CBNG) wells presently exist inside and around the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts. BLM's evaluation of the potential for conflict with the development of oil and gas resources within the four LBA tracts is included in the "Other Mineral Resources" discussion in section 3.3 and in the "Land Use and Recreation" discussion in section 3.11 of this EIS. BLM's policy and guidance on conflicts between surface coal mines and conventional oil and gas and CBNG development is to optimize the recovery of these resources and ensure that the public receives a reasonable return, as explained in BLM Instruction Memorandum No. 2006-153 (BLM 2006a).

The fourth coal screening procedure requires consultation with surface owners who meet the criteria defined in the regulations at 43 CFR 3400.0-5(gg)(1) and (2). Chapter 7 includes a definition of the term "qualified surface owner", based on these regulations. Surface owner consultation was conducted as part of the coal

screening analysis published in the 2001 Buffalo RMP update. Private surface owners in the Gillette coal development potential area were provided the opportunity to express their preference for or against surface mining of federal coal under their private surface estate during that screening. At that time, no attempt was made to distinguish qualified surface owners and appendix D of the 2001 Buffalo RMP update states that "no area should be dropped from further consideration for leasing as a result of responses received from surface owners". Therefore, no federal coal lands within the tracts were eliminated from further consideration for leasing due to qualified surface owner conflicts at this time. The current surface ownership of the tracts is discussed in section 1.1 of this chapter and in section 3.11. Private surface owners who are found to be qualified must consent to leasing before BLM can offer the underlying federal coal for lease. BLM will review current surface ownership in the tracts that will be considered for leasing prior to holding a lease sale for each tract. Surface owner consultation must be completed with any private surface owners who are determined to be qualified, prior to holding a lease sale for a tract.

In summary, the lands in the FCW, ALC, CCC, and CMC coal lease applications have been subjected to the four coal planning screens and determined acceptable for further consideration for leasing. Thus, a decision to lease the federal coal lands in these applications would be in conformance with the current BLM Buffalo RMP.

1.6 Consultation and Coordination

Initial Involvement

BLM received the Belle Ayr North coal lease application on July 6, 2004; the West Coal Creek coal lease application on February 10, 2006; the Caballo West coal lease application on March 15, 2006; and the Maysdorf II coal lease application on September 1, 2006. The BLM Wyoming State Office-Division of Mineral and Lands initially reviewed the applications. BLM ruled that these applications and the lands involved met the requirements of regulations governing coal leasing on application (43 CFR 3425).

The BLM State Director notified the Governor of Wyoming on March 14, 2007 that FCW had filed a lease application with BLM for the Belle Ayr North LBA tract. The Governor was notified on September 18, 2006 that ALC had filed a lease application for the West Coal Creek LBA tract and that CMC had filed a lease application for the Maysdorf II LBA tract. The Governor was notified that CCC had filed a lease application for the Caballo West LBA tract on April 27, 2006.

A notice announcing the receipt of the Belle Ayr North coal lease application published in the *Federal Register* on March 8, 2005, a BLM news release announcing the receipt of the Caballo West and West Coal Creek coal lease applications issued on March 27, 2006, and a notice announcing the receipt of the

Maysdorf II coal lease application published in the *Federal Register* on December 12, 2006 served as public notice that these coal lease applications had been received. Copies of the notices were sent to voting and nonvoting members of the PRRCT, including the governors of Wyoming and Montana, the Northern Cheyenne Tribe, the Crow Tribal Council, OSM, U.S. Fish and Wildlife Service (USFWS), National Park Service, and U.S. Geological Survey (USGS).

The PRRCT reviewed the Belle Ayr North Tract at a public meeting held on April 24, 2005, in Gillette, Wyoming, the West Coal Creek and Caballo West Tracts at a public meeting held on April 19, 2006, in Casper, Wyoming, and the Maysdorf II Tract at a public meeting held on January 18, 2007, in Casper, Wyoming. Each of the applicants presented information about their existing mine and the pending lease application to the PRRCT at those meetings. The PRRCT recommended that BLM continue to process these applications. The major steps in processing an LBA are shown in appendix C.

BLM published a Notice of Intent to Prepare an Environmental Impact Statement and Notice of Public Meeting in the *Federal Register* on March 29, 2007 and in the *Gillette News-Record* on April 4, 2007. The publications announced the time and location of a public scoping meeting and requested public comment on all four of the applications. Letters requesting public comment and announcing the time and location of the public scoping meeting were also mailed to all parties on the distribution list on March 26, 2007.

A public scoping meeting was held on April 11, 2007 in Gillette, Wyoming. At the public meeting, the applicants orally presented information about their mines and their need for the coal. The presentations were followed by a question and answer period, during which no oral comments were made. The scoping period extended from March 29 through June 10, 2007, during which time BLM received written, e-mailed, and telephoned comments from six entities.

Chapter 5 provides a list of other federal, state, and local governmental agencies that were consulted in preparation of this EIS and the distribution list for this EIS.

Issues and Concerns

Issues and concerns that have been expressed by the public and government agencies relating to the potential impacts of leasing the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts, specifically, and to previous coal lease applications in general include:

- potential conflicts between coal mining and existing and proposed conventional oil and gas and CBNG development;
- potential cumulative impacts of coal leasing decisions combined with other existing and proposed development in the Wyoming PRB;

- potential impacts to transportation routes;
- potential impacts to people living in the area;
- socioeconomic concerns;
- potential impacts to ranching operations associated with the loss of grazing leases and permits;
- noxious weed concerns;
- potential impacts to visual resources;
- potential impacts to cultural and paleontological resources;
- potential impacts to greater sage-grouse and other wildlife;
- potential impacts to threatened and endangered species and other species of concern;
- potential impacts to wetland resources;
- potential impacts related to coal loss during rail transport;
- potential air quality impacts and cumulative impacts to visibility;
- potential surface and groundwater quality and quantity impacts;
- potential impacts associated with nitrogen oxide emissions resulting from the blasting of coal and overburden;
- human health impacts;
- the need to address reasonably foreseeable actions, including the construction and operation of the DM&E railroad and power plants, in the cumulative analysis;
- the need to address mercury, coal combustion residues, and other by-products from coal-fired power plants;
- the need to address increasing PRB coal production in the cumulative analysis;
- the need to address site-specific greenhouse gas emissions;
- ozone; and
- climate change.

Draft EIS

Parties on the distribution list were sent copies of the Draft EIS, and copies were made available for review at the BLM offices in Casper and Cheyenne, Wyoming. The document was also available for review on the BLM Wyoming website at http:// www.blm.gov/wy/st/en/info/NEPA/cfodocs/south_gillette.html.

EPA published a notice announcing the availability of the draft EIS in the *Federal Register* on October 24, 2008. A 60-day comment period on the draft EIS commenced with publication of that notice and ended on December 24, 2008. BLM published a Notice of Availability/Notice of Public Hearing in the *Federal Register* on October 17, 2008. The BLM's *Federal Register* notice announced the date and time of a public hearing, which was held on November 19, 2008 at 7:00 pm at the Campbell County George Amos Memorial Building. The purpose of the public hearing was to solicit public comments on the draft EIS and on the fair market value, the maximum economic recovery, and the proposed competitive sale of federal coal from the LBA tracts. BLM also published a notice of public hearing

in the *Gillette News-Record* on October 26, 2008. A transcript of the public hearing is available for review in appendix I of this document.

Final EIS and Future Involvement

BLM received 18 written comments on the draft EIS. These comments are included, with agency responses, as appendix I in this final EIS. Availability of the final EIS will be published in the *Federal Register* by BLM and EPA. After a 30-day availability period, BLM will make separate decisions to hold or not to hold a competitive lease sale for the federal coal in each of the four tracts.

A ROD for each of the tracts will be mailed to parties on the mailing list and others who commented on this EIS during the NEPA process. The public or the applicant can appeal the BLM decision to hold or not to hold a competitive sale and issue a lease for any of the four tracts. The BLM decision must be appealed within 30 days from the date the notice of availability for the ROD is published in the *Federal Register*. The decision can be implemented at that time if no appeal is received. If competitive lease sales are held, the lease sales will follow the procedures set forth in 43 CFR 3422, 43 CFR 3425, and BLM Handbook H-3420-1 (Competitive Coal Leasing).

Department of Justice Consultation

After each competitive coal lease sale, but prior to issuance of the lease, BLM must solicit the opinion of the Department of Justice on whether the planned lease issuance creates a situation inconsistent with federal antitrust laws. The Department of Justice is allowed 30 days to make this determination. BLM can proceed with issuance of the lease if the Department of Justice has not responded in writing within the 30 days.

2.0 PROPOSED ACTION AND ALTERNATIVES

This chapter describes the Proposed Action and alternatives for each of the four lease by application (LBA)[1] tracts being evaluated by this environmental impact statement (EIS). The four tracts are the Belle Ayr North LBA tract as applied for by Foundation Coal West (FCW), the West Coal Creek LBA tract as applied for by Ark Land Company (ALC), the Caballo West LBA tract as applied for by Caballo Coal Company (CCC), and the Maysdorf II LBA tract as applied for by Cordero Mining Company (CMC).

For each tract, the Proposed Action is to hold a competitive lease sale and issue a lease for the federal coal lands included in the tract as applied for by the applicant. Under each Proposed Action, the tract as applied for would be offered for lease at one competitive sealed bid lease sale, subject to standard and special lease stipulations developed for the Powder River Basin (PRB) and that tract. The boundaries of each tract would be consistent with the tract configuration proposed by each applicant. Figures 2-1 through 2-4 show the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts, respectively, under each Proposed Action. In each case, the Proposed Action assumes that the applicant would be the successful bidder on each tract, and that the tract would be mined as a maintenance lease for an existing mine.

The National Environmental Policy Act of 1969 (NEPA) requires the consideration and evaluation of other reasonable ways to meet proposal objectives while minimizing or avoiding environmental impacts. Thus, NEPA requires the evaluation of a No Action alternative and a practical range of other "reasonable" alternatives that may avoid or minimize project impacts. Reasonable alternatives are defined by NEPA as those that are technically, economically, and environmentally practical and feasible. Reasonable alternatives are formulated to address issues and concerns raised by the public and agencies during scoping. These other alternatives should represent other means of satisfying the stated purpose and need for the federal action.

The No Action alternative (Alternative 1) for each tract considered in this EIS is to reject the lease application. Under the No Action alternative, a tract would not be offered for competitive sale, and the coal contained within the tract would not be mined as proposed. Rejection of an application would not affect currently permitted mining activities on existing leases at any of the applicant mines and selection of the No Action alternative would not preclude an application to lease any rejected tract in the future. Portions of the surface of each LBA tract would probably be disturbed due to overstripping to allow coal to be removed from the adjacent existing leases.

[1] Refer to page xxiii for a list of abbreviations and acronyms used in this document.

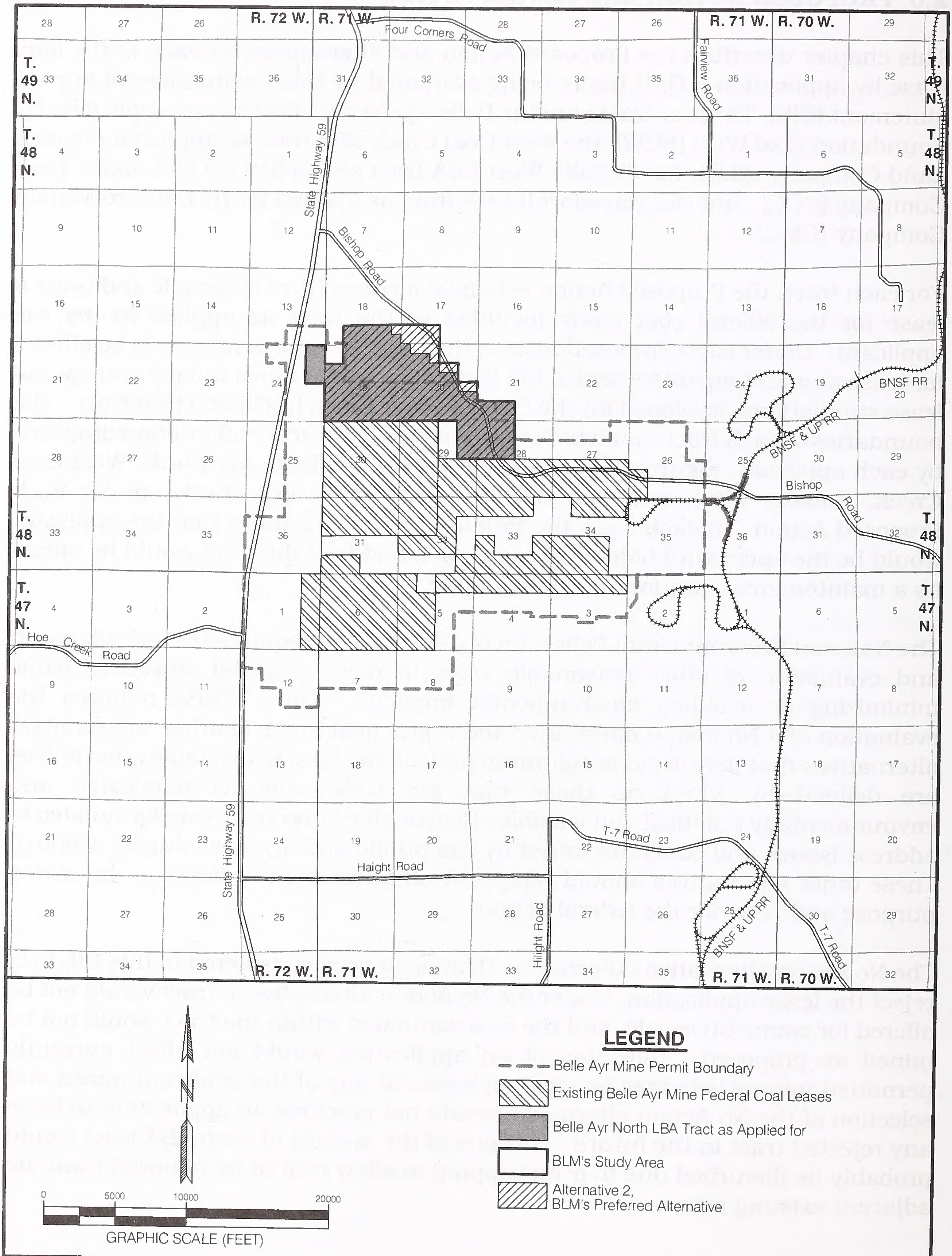


Figure 2-1. Belle Ayr North LBA Tract Alternatives.

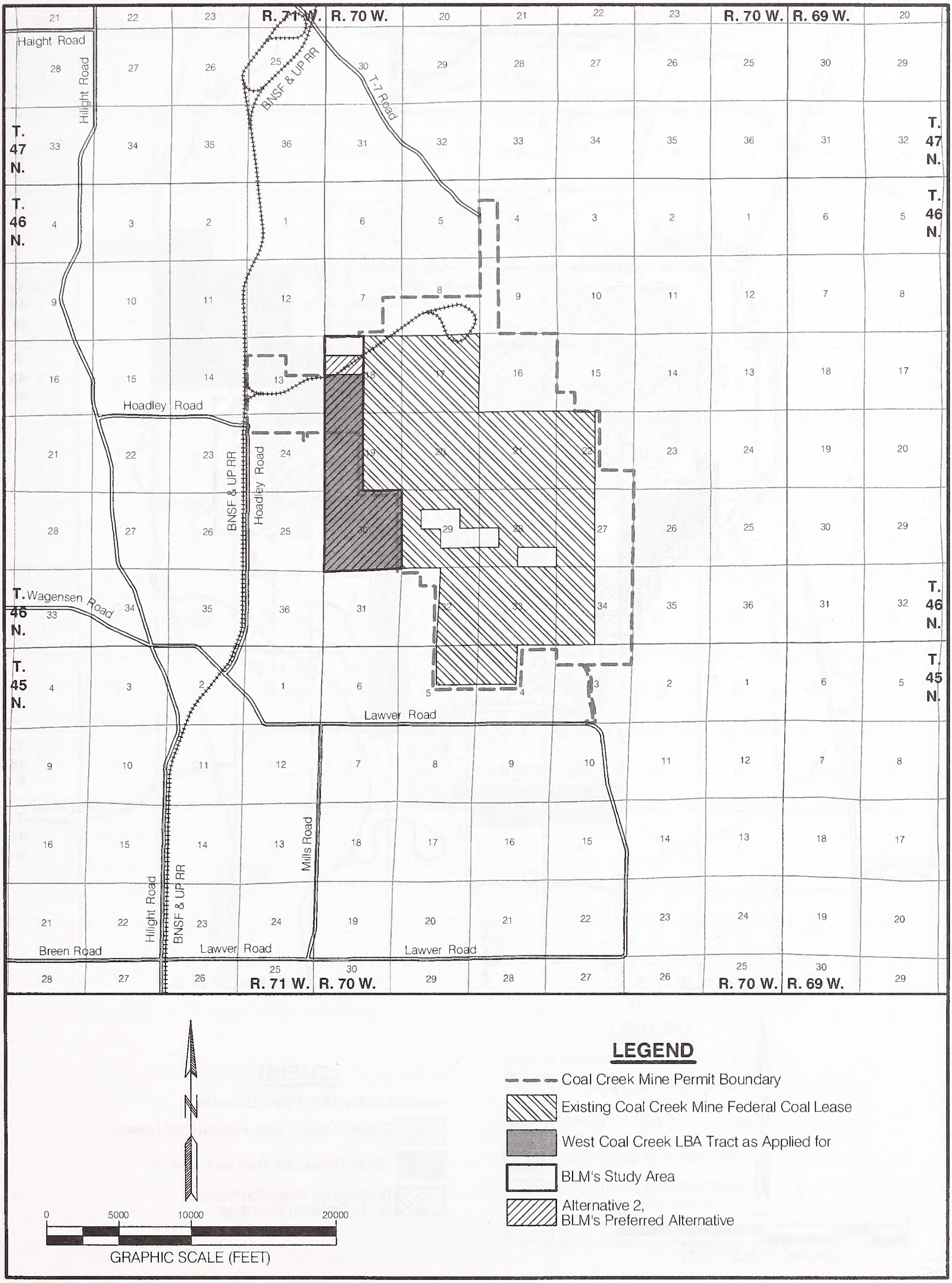


Figure 2-2. West Coal Creek LBA Tract Alternatives.

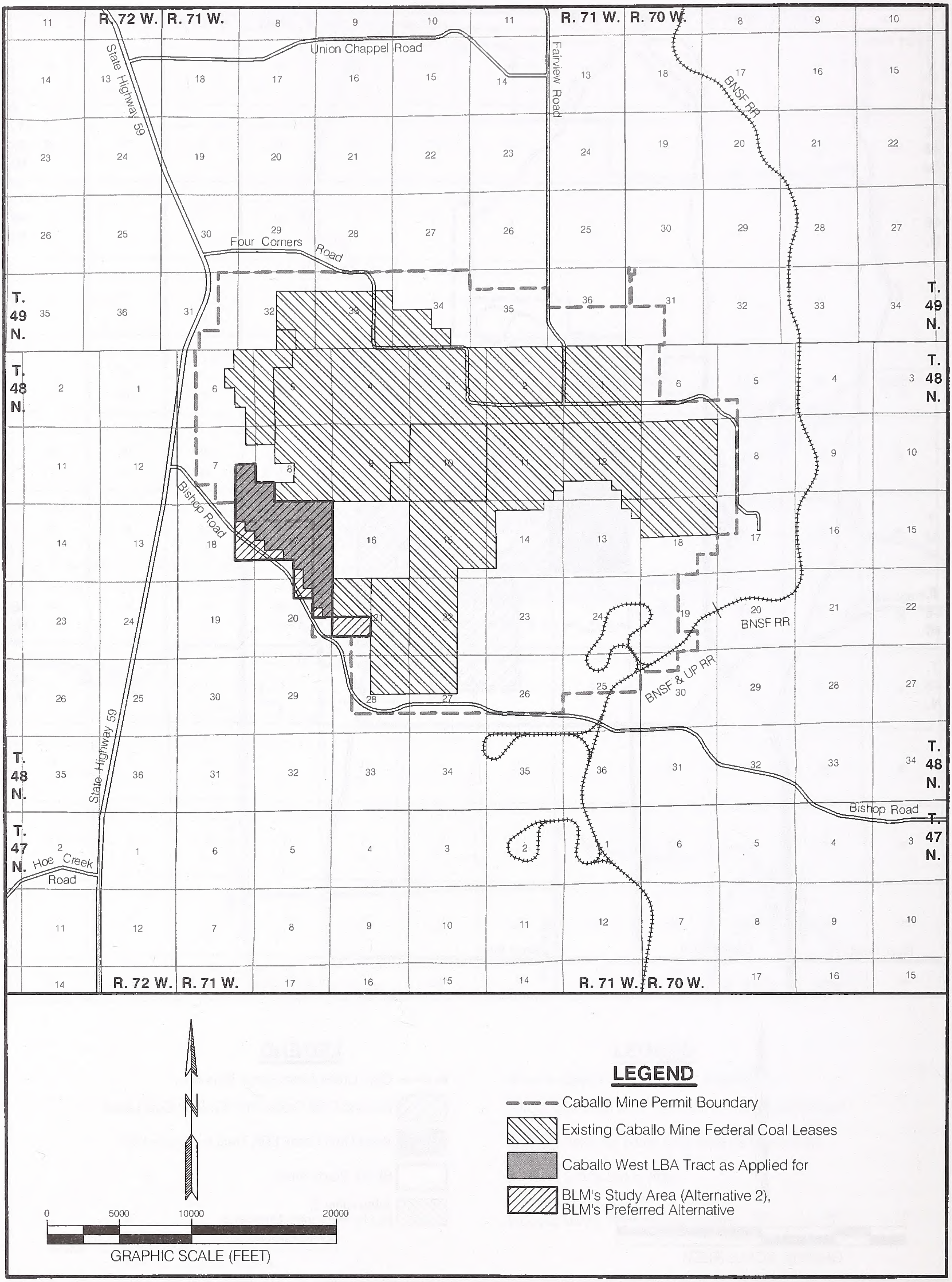


Figure 2-3. Caballo West LBA Tract Alternatives.

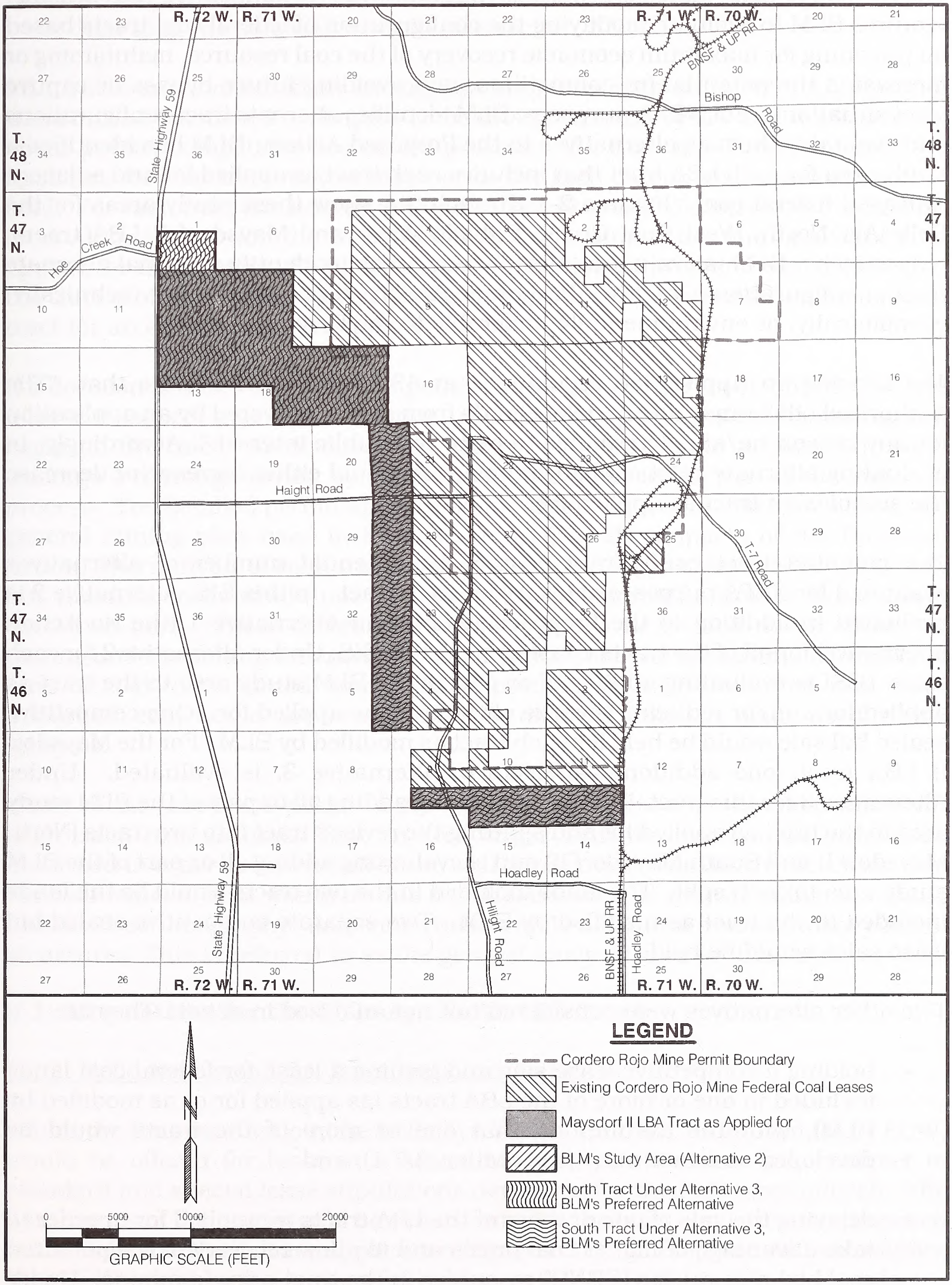


Figure 2-4. Maysdorf II LBA Tract Alternatives.

The Bureau of Land Management (BLM) Manual 3420-1 (Competitive Coal Leasing) requires BLM to evaluate modifying the configuration of federal coal tracts based on providing for maximum economic recovery of the coal resource, maintaining or increasing the potential for competition, and avoiding future bypass or captive tract situations. For NEPA purposes, BLM identifies alternate tract configurations and evaluates them as alternatives to the Proposed Action. BLM has identified a study area for each LBA tract that includes each tract as applied for and adjacent unleased federal coal. Figures 2-1 through 2-4 show these study areas for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts, respectively. BLM is evaluating these study areas to identify potential alternate tract configurations to the Proposed Action that would be technically, economically, or environmentally preferable to the Proposed Action.

The Leasing on Application regulations at 43 CFR 3425.1-9 state that: "The authorized officer may add or delete lands from an area covered by an application for any reason he/she determines to be in the public interest." Accordingly, in evaluating alternate tract configurations, BLM could either increase or decrease the size of each tract as applied for.

The potential tract configurations and the potential number of alternatives evaluated for NEPA purposes can vary for each tract. In this EIS, Alternative 2 is evaluated in addition to the Proposed Action and Alternative 1 (the No Action alternative) for all of the tracts considered in this EIS. Under Alternative 2 for each tract, BLM is evaluating adding all or part of the BLM study area to the tract as applied for and/or reducing the size of the tract as applied for. One competitive sealed bid sale would be held for each tract as modified by BLM. For the Maysdorf II LBA tract, one additional alternative, Alternative 3, is evaluated. Under Alternative 3 for this tract, BLM is considering adding all or part of the BLM study area to the tract as applied for and splitting the revised tract into two tracts (North Maysdorf II and South Maysdorf II) and is evaluating adding all or part of the BLM study area to each split. The lands included in the two tracts would be the lands included in the tract as modified by BLM. Two separate competitive sealed bid lease sales would be held.

Two other alternatives were considered but not analyzed in detail. They are:

- holding a competitive lease sale and issuing a lease for federal coal lands included in one or more of the LBA tracts (as applied for or as modified by BLM), with the assumption that one or more of the tracts would be developed as a new mine (see section 2.7.1), and

- delaying the sale of one or more of the LBA tracts as applied for in order to take advantage of higher coal prices and to allow recovery of the potential coal bed natural gas (CBNG) resources in the tract prior to mining. Under this alternative, it is assumed that one or more of the tracts could be

developed later as a maintenance tract or a new mine start, depending on how long the sale was delayed (see section 2.5.2).

LBA tracts are nominated for leasing by companies with an interest in acquiring them but, as discussed in chapter 1, the LBA process is, by law and regulation, an open, public, competitive sealed-bid process. If a tract is offered for lease, the applicant for that tract may or may not be the high bidder when the lease sale is held. For each tract considered in this EIS, the Proposed Action and Alternative 2 (and Alternative 3 for the Maysdorf II Tract) assume that the applicant that applied for the tract would be the successful bidder if the federal coal included in the tract is offered for lease, and that each tract would be mined as a maintenance tract for an existing permitted mine.

If a decision is made to hold a competitive lease sale for a tract of federal coal and a lease is issued, a permit to conduct coal mining operations before mining can begin on the tract. As discussed in section 1.3, this permit application would undergo a thorough review by state and federal agencies as part of the approval process. The detailed permit application for each tract could differ from the more general mining plan used in this EIS to analyze the impacts of the Proposed Action, Alternative 2 of each tract, and Alternative 3 for the Maysdorf II LBA tract, but the differences would not be expected to substantially change the impacts described here. These differences would typically be related to the details of mining and reclaiming the tract but major factors like the approximate number of tons of coal to be mined and yards of overburden to be removed, the acres disturbed, etc., would not be substantially different from the plans used in this analysis.

If any of the tracts are leased under the Proposed Action or the alternatives for each tract, it is assumed that an area larger than the tract would have to be disturbed in order to recover all of the coal in the tract. The disturbances outside the coal removal area would be due to activities such as overstripping, matching undisturbed topography, and construction of flood control and sediment control structures. This is referred to as the general analysis area for that tract.

2.1 Alternatives for the Belle Ayr North LBA Tract

2.1.1 Belle Ayr North LBA Tract Proposed Action

Under the Proposed Action, the Belle Ayr North LBA tract, as applied for by FCW, would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the PRB (appendix D). The boundaries of the tract would be consistent with the tract configuration proposed in the Belle Ayr North lease application (figure 2-1). The Proposed Action assumes that FCW would be the successful bidder on this tract if it is offered for sale.

The legal description of the proposed coal lease lands as applied for by FCW under the Proposed Action is as follows:

T. 48 N., R. 71 W., 6th P.M., Campbell County, Wyoming

Section 18: Lots 17, 18, 19(W½, SE¼);	113.48 acres
Section 19: Lots 5 through 19;	606.93 acres
Section 20: Lots 3 (SW¼), 4 (W½, SE¼), 5, 6, 7 (S½), 9 (S½), 10 through 16;	450.43 acres
Section 21: Lots 13, 14;	81.52 acres
Section 28: Lots 3 through 6;	161.98 acres
Section 29: Lots 1, 6;	81.63 acres

T. 48 N., R.72 W., 6th P.M., Campbell County, Wyoming

Section 24: Lots 1, 8.	82.77 acres
Total:	1,578.74 acres

The land description and acreage are based on the BLM Status of Public Domain Land and Mineral Titles approved Master Title Plat as of April 10, 2006 and Coal Plat as of March 8, 2006. The coal estate included in the tract described above is federally owned and the surface is owned by FCW. Ownership of the oil and gas estate is discussed in section 3.11.

Under the Proposed Action, some of the coal in the tract is considered to be unmineable because a portion of the Bishop Road (Campbell County Road 12) overlies the coal. As discussed in section 1.1, the Surface Mining Control and Reclamation Act prohibits mining within 100 feet on either side of the right-of-way (ROW) of any public road (43 CFR 3461). There would also be some coal east of the Bishop Road that would be isolated from the mining operations if the coal under the road was not mined. The coal underlying the portion of the road, its ROW, and the 100 foot buffer zone within the tract could be mined if the Campbell County Board of Commissioners (authorized agency) determines that the road can be moved [30 CFR 761.11(d)]. FCW is currently evaluating the feasibility of relocating the road. They estimate that approximately 27.2 million tons of mineable coal are included within the ROW and associated 100 foot buffer zone that is within the LBA tract. If the county road is not moved approximately 12.7 million tons of mineable coal would be isolated east of the Bishop Road.

The federal coal lands underlying the county road ROW and the adjacent buffer zone are included in the tract because that would allow maximum recovery of the mineable coal adjacent to but outside of those areas if the road is not moved. It would also allow recovery of the coal under the road if it is moved. If a lease is issued for this tract, a stipulation will be attached stating that no mining activity

may be conducted within 100 feet of the road ROW until permit to move the county road is approved.

FCW estimates that the Belle Ayr North LBA tract as applied for includes approximately 208.1 million tons of in-place and mineable coal. If the Bishop Road is moved, FCW assumes that about 94 percent of that coal, or about 191.9 million tons, could be recovered from the tract, based on historical recovery practices. FCW estimates that at the projected average annual coal production rate of 30 million tons per year (mmtpy), the mine life would be extended by about 6.4 years. As a basis for estimating impacts, annual production is assumed to increase to 30 mmtpy by 2015 and hold at that rate through 2020 and to the end of mine life. Future production rates are difficult to estimate since mines must increase or reduce rates in line with annual demand and competition for coal sales. BLM estimated future rates for the purpose of estimating impact using the *Task 2 Report for the Powder River Basin Coal Review – Past and Present and Reasonably Foreseeable Development Activities* (BLM 2005a). This results in an average production rate from mid 2008 to the end of mine life of 30 mmtpy.

If the Bishop Road is not moved, FCW estimates that the tract contains approximately 164.7 million tons of mineable coal reserves. The federal coal reserves within the road ROW and buffer zone and the isolated coal would be excluded. Using FCW's projected recovery factor of 94 percent of the mineable coal reserves included in tract as applied for, the tract would contain about 154.8 million tons of recoverable coal. At the average annual coal production rate of 30 mmtpy, mining this coal would extend mine life by about 5.2 years.

BLM independently evaluates the volume and average quality of the coal resources included in the tract offered for sale as part of the fair market value determination process. That estimate may not be in agreement with the applicant's estimates. BLM's estimate will be published in the sale notice for the tract, if it is offered for sale.

The Belle Ayr North LBA tract would be mined as an integral part of the Belle Ayr Mine under the Proposed Action. Since the Belle Ayr North LBA tract would be an extension of the existing Belle Ayr Mine, the facilities and infrastructure would be the same as those identified in the Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD) Mine Permit 214 Term T6, approved November 25, 2003 and the BLM Resource Recovery and Protection Plan (R2P2), which was approved March 8, 2007.

FCW's currently approved air quality permit from the Wyoming Department of Environmental Quality/Air Quality Division (WDEQ/AQD) for the Belle Ayr Mine allows up to 45 million tons of coal per year to be mined. The Belle Ayr Mine produced:

- 11.8 million tons of coal in 2001,

- 17.5 million tons of coal in 2002,
- 17.9 million tons of coal in 2003,
- 18.7 million tons of coal in 2004,
- 19.5 million tons of coal in 2005,
- 24.6 million tons of coal in 2006, and
- 26.6 million tons of coal in 2007

(Wyoming Department of Employment 2001, 2002, 2003, 2004, 2005, 2006, and 2007a).

Under the currently approved mining plan (the No Action alternative), the Belle Ayr Mine would mine its remaining 235.8 million tons of recoverable coal reserves on the existing leases in nearly 8 years at an average production rate of approximately 30 mmtpy. Under the Proposed Action and if the Bishop Road is moved, FCW estimates that annual coal production would average approximately 30 million tons, mine life would be extended by more than 6 additional years, and coal production at the mine would continue for just over 14 years beyond mid 2008. If the road is not moved, FCW estimates that annual coal production would average approximately 30 million tons, mine life would be extended by more than 5 additional years, and coal production at the mine would continue for nearly 14 years beyond mid 2008.

If FCW acquires the Belle Ayr North LBA tract as applied for and Bishop Road is moved, they estimate that a total of 427.7 million tons of coal would be recovered after July 1, 2008, with an estimated 191.9 million tons coming from the LBA tract. As of June 30, 2008, approximately 544.5 million tons of coal had been mined from within the current permit area of the Belle Ayr Mine.

If FCW acquires the tract as applied for and Bishop Road is not moved, they estimate that a total of 390.6 million tons of coal would be recovered after July 1, 2008, with an estimated 154.8 million tons coming from the LBA tract.

Prior to disturbance and in advance of mining, mine support structures such as roads, power lines, substations, and flood and sediment control measures would be built as needed. Two telephone lines, one high-pressure gas pipeline, and a portion of the Bishop Road would require relocation before mining commences.

Topsoil removal with suitable heavy equipment, such as rubber-tired scrapers, would proceed ahead of overburden removal. Whenever possible, direct haulage to a reclamation area would be done, but due to scheduling, some topsoil would be temporarily stockpiled. As required by the reclamation plan, heavy equipment would be used to haul and distribute the stockpiled topsoil.

The Belle Ayr Mine is one of several mines currently operating in the PRB where the coal seams are notably thick and the overburden is relatively thin. Mining would be conducted as an extension of the one pit located within the current permit area. Overburden removal has been and would continue to be conducted

using trucks and shovels. Other equipment used during overburden removal and backfilling would include dozers, scrapers, excavators, front-end loaders, graders, and water trucks. Most overburden and all coal have been and would continue to be drilled and blasted to facilitate efficient excavation. The design of the Belle Ayr Mine seeks to confine disturbance to the active mine blocks. As overburden is removed, most would be directly placed into areas where coal has already been removed.

Chapter 4, Section 2(b)(i) of the WDEQ/LQD Coal Rules requires that rough backfilling and grading follow coal removal as closely as possible based on the mining conditions (WDEQ/LQD 2005a). According to a recent Office of Surface Mining Reclamation and Enforcement (OSM) evaluation of the Wyoming coal mining industry, the 2007 reclamation to disturbance ratio was approximately 80 percent (12,258 acres reclaimed vs. 15,321 acres disturbed) (OSM 2008). Replaced (backfilled) overburden is graded to approximate original land surface contour, as required by WDEQ and OSM rules. Elevations consistent with an approved post-mining topography (PMT) plan would be established as quickly as possible to construct a stable landscape and restore drainage. Backfilled and recontoured overburden is sampled and analyzed to verify suitability as subsoil. Material that is found to be unsuitable for reclamation (i.e., material that is not suitable for use in reestablishing vegetation or that may affect groundwater quality due to high concentrations of certain constituents, such as selenium or adverse pH levels) would either be removed and treated, or adequately covered with suitable overburden material prior to topsoiling. Under certain conditions, the PMT may not be immediately achievable. This occurs when excess material may require temporary stockpiling, when there is insufficient material available from current overburden removal operations, or when future mining could redisturb an area already mined area.

Once a seedbed has been prepared, vegetation that is consistent with the post-mining land use would be reestablished. The reseeded area would be monitored to evaluate the success of revegetation growth and the variety of established plant species for a minimum of 10 years, before to final reclamation bond release. WDEQ/LQD requires that mining companies post a bond that would cover the cost of completing reclamation on all mining disturbed acres within their permit boundary. In order to meet the conditions for final bond release, the reclaimed area must have vegetative cover and production and plant species diversity equal to a predetermined native comparison (reference) area. The reclaimed area must have a shrub density of one per square meter over 20 percent of the area. It must also support the post-mining land use (grazing and wildlife), as determined by grazing trials and by monitoring of wildlife use on the reclaimed. This lengthy period required for final bond release means that the total acres listed as reclaimed likely includes areas completely reclaimed and areas in various stages of being reclaimed.

Coal would be produced from one coal seam referred to as the Wyodak-Anderson. The seam averages 72 feet in thickness and ranges from between 66 to 76 feet thick inside the Belle Ayr North LBA tract. Coal would be mined at several working faces to enable blending of the coal to meet customer quality requirements, to comply with BLM lease requirements for maximum economic recovery of the coal resource, and to optimize coal removal efficiency with available equipment. Coal would be loaded with electric-powered shovels into off-highway haul trucks for transport to crushing facilities. Coal haul roads would be temporary structures built within the mine areas. The Belle Ayr Mine uses two existing coal crushing facilities located within the FCW mine permit area, which provide the capacity to produce the permitted production tonnage. All coal crushing operations and conveying, transferring, and storage facilities are equipped with baghouses, atomizer/fogger systems, and passive enclosure control (PEC) systems for dust control. A system of crushers, feeders, and transfer conveyors move the prepared coal to interim storage in four concrete silos located adjacent to the unit train loadout facility. While sufficient storage capacity exists, facilities may be constructed in the future to improve operating efficiency and air quality protection. For example, a stilling shed may be built and a covered overland conveyor and near-pit crusher system may be constructed and moved as the mining operation progresses.

Full-time employment at the Belle Ayr Mine is currently 358 personnel. If FCW acquires the Belle Ayr North LBA tract under the Proposed Action, they anticipate that employment levels would increase to 366 for the additional 5 to 7 years that it would take to mine the coal included in the tract. This assumes that the annual coal production rate would average approximately 30 mmtpy.

FCW applied for the tract, but the tract is also adjacent to the Caballo Mine, operated by CCC (see figure 1-2). As a result, CCC is potentially in a position to mine the Belle Ayr North LBA tract. If a company other than FCW were to acquire the tract, the rate of coal production, mining sequence, equipment, and facilities would be different than if FCW acquired the tract as a maintenance lease, as described above. However, the area of disturbance and the impacts of removing the coal would not be substantially different from the area of disturbance and the impacts if FCW acquires the tract.

2.1.2 Belle Ayr North LBA Tract Alternative 1

Under Alternative 1 (No Action alternative) for the Belle North LBA tract, FCW's application to lease the coal included in the Belle Ayr North LBA tract would be rejected. The tract would not be offered for competitive sale at this time, and the coal included in the tract would not be mined. Under this alternative, the Belle Ayr Mine would mine its remaining 235.8 million tons of recoverable coal reserves on the existing Belle Ayr leases in nearly 8 years at an average production rate of approximately 30 mmtpy.

Rejection of the application would not affect permitted mining activities or employment the Belle Ayr Mine. The mine currently owns or leases approximately 4,946 acres of federal coal, 760 acres of private coal, and 640 acres of state coal, all of which are within the existing mine permit boundaries. A total of approximately 11,621 acres will eventually be affected in mining the current leases. If the Belle Ayr North LBA tract is not leased, FCW estimates that the annual production at the Belle Ayr Mine would average 30 million tons, and the average full-time employment level would be 358 persons.

In order to compare the economic and environmental consequences of mining these lands versus not mining them, this EIS was prepared under the assumption that the Belle Ayr North LBA tract would not be mined in the foreseeable future if the No Action alternative is selected. However, selection of the No Action alternative would not preclude leasing and mining of this tract in the future. If the decision is made to reject FCW's application at this time, the tract could be leased as a maintenance tract in the future while the adjacent mine is in operation. If it is not leased while the existing adjacent mine is in operation, it may or may not be leased in the future. This tract does not include enough coal reserves to economically justify mining by a new operation; however, the coal reserves included in the tract could be combined with unleased federal coal to the west to create a larger tract, which could be mined by a new operation in the future.

2.1.3 Belle Ayr North LBA Tract Alternative 2

Under Alternative 2, BLM would reconfigure the tract, hold one competitive coal sale for the lands included in the reconfigured tract, and issue a lease to the successful bidder. The modified tract would be subject to standard and special lease stipulations developed for the PRB and for this tract if it is offered for sale (appendix D). Alternative 2, holding a competitive coal sale for a modified tract, is BLM's Preferred Alternative.

This alternative assumes that FCW would be the successful bidder on the tract if a lease sale is held and that the federal coal would be mined as a maintenance lease for the existing Belle Ayr Mine. Assumptions concerning mining methods, facilities, hazardous materials, mitigation and monitoring requirements, etc. are the same as described for the Proposed Action.

As applied for, the Belle Ayr North LBA tract consists of a single block of federal coal (figure 1-2). BLM identified a study area to evaluate the potential that an alternate configuration of the tract would provide more efficient recovery of the federal coal, increase competitive interest in the tract, and reduce the potential that some of the remaining unleased federal coal in this area would be bypassed in the future. The BLM study area includes the tract as applied for and unleased federal coal adjacent to the northern edge of the tract as applied for (figure 2-1). Under this alternative, BLM could add all or part of the adjacent lands to the

tract, or BLM could reduce the size of the tract, as discussed in section 2.0. The original BLM study area was redelineated on June 20, 2007 to describe the tract based on 10-acre aliquot parts rather than physical boundaries (Bishop Road). FCW was aware of and agreed to the change.

Under this alternative, the BLM evaluated the following lands to add to the tract as applied for:

T. 48 N., R. 71 W., 6th P.M., Campbell County, Wyoming

Section 17: Lots 13, 14;	82.53 acres
Section 18: Lots 19 (NE¼);	10.34 acres
Section 20: Lots 3 (E½, NW¼), 4 (NE¼), 7 (N½), and 9 (N½);	82.19 acres
Total Added:	175.06 acres

BLM would remove the following as applied for lands from leasing consideration if this alternative is selected:

T. 48 N., R.72 W., 6th P.M., Campbell County, Wyoming

Section 24: Lots 1, 8.	-82.77 acres
Total (Net Change):	92.29 acres

The legal description of BLM's preferred configuration of the Belle Ayr North LBA tract under Alternative 2 is as follows:

T. 48 N., R. 71 W., 6th P.M., Campbell County, Wyoming

Section 17: Lots 13, 14;	82.53 acres
Section 18: Lots 17, 18, 19;	123.82 acres
Section 19: Lots 5 through 19;	606.93 acres
Section 20: Lots 3 through 7, 9 through 16;	532.62 acres
Section 21: Lots 13, 14;	81.52 acres
Section 28: Lots 3 through 6;	161.98 acres
Section 29: Lots 1, 6.	81.63 acres
Total:	1,671.03 acres

The land description and acreage are based on the BLM Status of Public Domain Land and Mineral Titles approved Master Title Plat as of April 10, 2006 and Coal Plat as of March 8, 2006. The coal in the tract described above is federally owned and the surface is owned by FCW. Ownership of the oil and gas estate is discussed in section 3.11.

Under this alternative, some of the coal in this tract is considered unmineable because of the presence of the Bishop Road (Campbell County Road 12). A portion Bishop Road overlies some of the coal included in the tract. As discussed in section 1.1, the Surface Mining Control and Reclamation Act prohibits mining within 100 feet on either side of the ROW of any public road (43 CFR 3461). There would also be a quantity of coal east of Bishop Road that would be isolated from mining if the coal under the road was not mined. The coal underlying the portion of the Bishop Road, its ROW, and the 100 foot buffer zone within the Belle Ayr North LBA tract could be mined if the Campbell County Board of Commissioners (authorized agency) determines that the road can be moved [30 CFR 761.11(d)]. FCW is currently evaluating the feasibility of relocating the road. They estimate that approximately 45 million tons of mineable coal are included within the ROW and associated 100 foot buffer zone that is within the LBA tract under Alternative 2 and that if the county road is not moved approximately 13 million tons of mineable coal would be isolated east of the Bishop Road.

The federal coal lands underlying the county road ROW and the adjacent buffer zone and the isolated coal are included in the tract because that would allow maximum recovery of the mineable coal adjacent to but outside of the county road and buffer zone if the road is not moved. It would also allow recovery of the coal under the road if it is moved. If a lease is issued for this tract, a stipulation will be attached stating that no mining activity may be conducted within 100 feet of the road ROW until permit to move the county road is approved.

If the Bishop Road is moved, FCW estimates that under Alternative 2 the tract includes approximately 221.1 million tons of in-place coal and 217.6 million tons of mineable coal. FCW assumes that about 94 percent of that coal (204.6 million tons of coal) could be recovered, based on historical recovery practices. FCW estimates that at the projected average annual coal production rate of 30 mmtpy, mining this coal would extend this mine life by just under 7 years.

If the Bishop Road is not moved, FCW estimates that as applied for the tract contains approximately 221.1 million tons of in-place coal reserves. Excluding the federal coal reserves within the Bishop Road ROW and buffer zone and the isolated coal, FCW estimates that the tract contains approximately 159.6 million tons of mineable coal reserves. Using FCW's projected recovery factor of 94 percent of the mineable coal reserves included in tract as applied for, the tract would contain about 150.1 million tons of recoverable coal. Under Alternative 2, FCW estimates that at the average annual coal production rate of 30 mmtpy, mining this coal would extend the mine life by approximately 5 years.

BLM independently evaluates the volume and average quality of the coal resources included in the tract offered for sale as part of the fair market value determination process. This estimate may not be in agreement with the estimate provided by the applicant. Under the Preferred Alternative (Alternative 2) BLM's estimate will be published in the sale notice for the tract, if it is offered for sale.

2.2 Alternatives for the West Coal Creek LBA Tract

2.2.1 West Coal Creek LBA Tract Proposed Action

Under the Proposed Action, the West Coal Creek LBA tract, as applied for by ALC, would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the PRB (appendix D). The boundaries of the tract would be consistent with the tract configuration proposed in the West Coal Creek lease application (figure 2-2). The Proposed Action assumes that ALC would be the successful bidder on the tract if it is offered for sale.

The legal description of the proposed coal lease lands as applied for by ALC under the Proposed Action is as follows:

T. 46 N., R. 70 W., 6th P.M., Campbell County, Wyoming

Section 18: Lots 14 through 17;	161.95 acres
Section 19: Lots 7 through 10, 15 through 18;	323.60 acres
Section 30: Lots 5 through 20.	665.71 acres
Total:	1,151.26 acres

The land description and acreage are based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plat as of August 10, 2006. The ownership of the coal estate in the tract described above is federal. The surface estate is owned by Dennis Edwards and Thunder Basin Coal Company, LLC. Ownership of the oil and gas estate is discussed in section 3.11.

ALC estimates that the West Coal Creek LBA tract includes approximately 63.3 million tons of in-place and mineable coal. Using ALC's projected recovery factor of 90 percent of the mineable coal reserves, the LBA tract as applied for would contain about 57.0 million tons of recoverable coal. At an average annual coal production rate of 13.4 mmtpy, mining would extend the mine life by just over 4 years. As a basis for estimating impacts, annual production is assumed to increase to 14 mmtpy by 2015 and hold at that rate through 2020 to the end of mine life. Future production rates are difficult to estimate since mines must increase or reduce rates in line with annual demand and competition for coal sales. BLM estimated future impact using the *Task 2 Report for the Powder River Basin Coal Review – Past and Present and Reasonably Foreseeable Development Activities* (BLM 2005a). This results in an average production rate from 2008 to the end of mine life of 13.4 mmtpy.

BLM independently evaluates the volume and average quality of the coal resources included in the tract offered for sale as part of the fair market value determination process. This estimate may not be in agreement with the estimate provided by the

applicant. BLM's estimate will be published in the sale notice for the tract, if it is offered for sale.

The West Coal Creek LBA tract would be mined as an integral part of the Coal Creek Mine under the Proposed Action. Since this tract would be an extension of the existing mine, the facilities and infrastructure would be the same as those identified in the WDEQ/LQD Mine Permit 483 Term T5, approved September 7, 2005 and the BLM R2P2, which was approved April 15, 2004.

ALC's currently approved air quality permit from the WDEQ/AQD for the Coal Creek Mine allows up to 50 million tons of coal per year to be mined. The Coal Creek Mine produced:

- no coal in 2001,
- no coal in 2002,
- no coal in 2003,
- no coal in 2004,
- no coal in 2005,
- 3.1 million tons of coal in 2006, and
- 10.2 million tons of coal in 2007

(Wyoming Department of Employment 2001, 2002, 2003, 2004, 2005, and 2006 and TBCC 2007).

Under the currently approved mining plan (No Action alternative), the Coal Creek Mine would mine its remaining 217.5 million tons of recoverable coal reserves on the existing Coal Creek leases in just over 16 years at an average production rate of approximately 13.4 mmtpy. Under the Proposed Action, ALC estimates that annual coal production would average approximately 13.4 million tons, mine life would be extended by just over 4 additional years, and coal production at the mine would continue for just over 20 years beyond mid 2008.

If ALC acquires the West Coal Creek LBA tract as applied for, they estimate that a total of 274.5 million tons of coal would be recovered after July 1, 2008, with an estimated 57.0 million tons coming from the LBA tract. As of June 30, 2008, approximately 68.9 million tons of coal had been mined from within the current permit area of the Coal Creek Mine.

Prior to disturbance and in advance of mining, mine support structures such as roads, power lines, substations, and flood and sediment control measures would be built as needed. Three overhead powerlines, one buried telephone line, and three buried pipelines would require relocation before mining can begin.

Topsoil removal with suitable heavy equipment, such as rubber-tired scrapers, would proceed ahead of overburden removal. Whenever possible, direct haulage to a reclamation area would be done but, due to scheduling, some topsoil would be

temporarily stockpiled. As outlined in the reclamation plan, heavy equipment would be used to haul and distribute the stockpiled topsoil.

The Coal Creek Mine is one of several mines operating in the PRB where the coal seams are notably thick and the overburden is relatively thin. Mining would be conducted in four separate, semi-independent pits; three located within the current permit area and one located within the proposed lease area. The multi-pit concept has been and would be used to reduce operating costs by blending production from areas having different stripping ratios and coal quality, and also to help stabilize manpower requirements. Overburden removal has been and would continue to be conducted using trucks and shovels or loaders, draglines, and direct cast blasting. Other equipment used during overburden removal and backfilling would include dozers, scrapers, excavators, front-end loaders, graders, and water trucks. Most overburden and all coal have been and would continue to be drilled and blasted to facilitate efficient excavation. The design of the Coal Creek Mine seeks to confine disturbance to the active mine blocks. As overburden is removed, most would be directly placed into areas where coal has already been removed.

Chapter 4, Section 2(b)(i) of the WDEQ/LQD Coal Rules requires that rough backfilling and grading follow coal removal as closely as possible based on the mining conditions (WDEQ/LQD 2005a). According to a recent OSM evaluation of the Wyoming coal mining industry, the 2007 reclamation to disturbance ratio was approximately 80 percent (12,258 acres reclaimed vs. 15,321 acres disturbed) (OSM 2008). Replaced (backfilled) overburden is graded to approximate original land surface contour, as required by WDEQ and OSM rules. Elevations consistent with an approved PMT plan would be established as quickly as possible to construct a stable landscape and restore drainage. Backfilled and recontoured overburden is sampled and analyzed to verify suitability as subsoil. Material that is found to be unsuitable for reclamation (i.e., material that is not suitable for use in reestablishing vegetation or that may affect groundwater quality due to high concentrations of certain constituents, such as selenium or adverse pH levels) would either be removed and treated, or adequately covered with suitable overburden material prior to topsoiling. Under certain conditions, the PMT may not be immediately achievable. This occurs when excess material may require temporary stockpiling, when there is insufficient material available from overburden removal operations, or when future mining could redisturb an already mined area.

Once a seedbed has been prepared, vegetation that is consistent with the post-mining land use would be reestablished. The reseeded area would then be monitored to evaluate the success of revegetation growth and the variety of established plant species for a minimum of 10 years before final reclamation bond release. WDEQ/LQD requires that mining companies post a bond that would cover the cost of completing reclamation on all mining disturbed acres within their permit boundary. In order to meet the conditions for final bond release, the

reclaimed area must have vegetative cover and production and plant species diversity equal to a predetermined native comparison (reference) area. The reclaimed area must have a shrub density of one per square meter over 20 percent of the area. It must also support the post-mining land use (grazing and wildlife), as determined by grazing trials and by monitoring of wildlife use on the reclaimed area. This lengthy period required for final bond release means that the total acres listed as reclaimed likely includes areas completely reclaimed and areas in various stages of being reclaimed.

Coal would be produced from one coal zone that Thunder Basin Coal Company (TBCC) refers to as the Wyodak-Anderson. The seam averages 36 feet thick inside the West Coal Creek LBA tract. The Wyodak-Anderson zone is split into two mineable coal seams: locally referred to as R1 and R3. Coal would be mined at several working faces to enable blending of the coal to meet customer quality requirements, to comply with BLM lease requirements for maximum economic recovery of the coal resource, and to optimize coal removal efficiency with available equipment. Coal would be loaded with shovels, loaders, or backhoes into off-highway haul trucks for transport to crushing facilities. Coal haul roads would be temporary structures built within the mine areas. The Coal Creek Mine uses two existing coal crushing facilities located within the mine's permit area, which provides the capacity to produce at the permitted level. All coal crushing operations and conveying, transferring, and storage facilities are equipped with baghouses or passive control equipment for dust control. There are two existing coal storage silos. A covered overland conveyor and near-pit crusher system have been constructed and will be moved as the mining operation progresses. While sufficient storage capacity exists, future changes in facilities may be constructed to improve operating efficiency and air quality protection. For example, a covered slot storage barn, covered dome, or other appropriate storage structure may be built.

Full-time employment at the Coal Creek Mine is currently 150 persons. If ALC acquires the West Coal Creek LBA tract under the Proposed Action, they anticipate that employment levels would increase to 160 for the additional 4 years that it would take to mine the coal included in the tract. This assumes that the annual coal production rate would average approximately 13.4 mmtpy.

As discussed in chapter 1, the tract is adjacent to existing leases at the Coal Creek Mine, but is not adjacent to leases at any of the other existing mines in this area (see figure 1-3). If a company other than ALC were to acquire the tract, the rate of coal production, mining sequence, equipment, and facilities would be different than if ALC acquired the tract as a maintenance lease. However, the area of disturbance and the impacts of removing the coal would not be substantially different from the area of disturbance and the impacts of TBCC mining the tract.

2.2.2 West Coal Creek LBA Tract Alternative 1

Under the No Action alternative, ALC's application to lease the coal included in the West Coal Creek LBA tract would be rejected, the tract would not be offered for competitive sale at this time, and the coal included in the tract would not be mined. Under this alternative, the Coal Creek Mine would mine its remaining 217.5 million tons of recoverable coal reserves on the existing Coal Creek leases in just over 16 years at an average production rate of approximately 13.4 mmtpy.

Rejection of the application would not affect permitted mining activity and employment on the existing leases at the Coal Creek Mine. The mine currently owns or leases approximately 5,918.0 acres of federal coal, 120.1 acres of private coal, and 805.7 acres of state coal; all of which are within the mine's existing permit boundary. A total of approximately 8,355 acres will eventually be affected in mining the current leases. If the tract is not leased, ALC estimates that the annual production at the mine would average 13.4 million tons, and the average full-time employment level is expected to remain at 150 persons.

In order to compare the economic and environmental consequences of mining these lands versus not mining them, this EIS was prepared under the assumption that the West Coal Creek LBA tract would not be mined in the foreseeable future if the No Action alternative is selected. However, selection of the No Action alternative would not preclude leasing and mining of this tract in the future. If the decision is made to reject the West Coal Creek lease application, the tract could be leased as a maintenance tract in the future while the adjacent mine is in operation. If it is not leased while the existing adjacent mine is in operation, it may or may not be leased in the future. This tract does not include enough coal reserves to economically justify mining by a new operation. However, the coal reserves included in the tract could be combined with unleased federal coal to the west and south to create a larger tract, which could be mined by a new operation in the future.

2.2.3 West Coal Creek LBA Tract Alternative 2

Under Alternative 2 for the West Coal Creek LBA tract, BLM would reconfigure the tract, hold one competitive coal sale for the lands included in the reconfigured tract, and issue a lease to the successful bidder. The modified tract would be subject to standard and special lease stipulations developed for the PRB and this tract if it is offered for sale (appendix D). Alternative 2, holding a competitive coal sale for a modified tract, is BLM's Preferred Alternative.

Alternative 2 assumes that ALC would be the successful bidder on the tract if a lease sale is held, and that the federal coal would be mined as a maintenance lease for the Coal Creek Mine. Assumptions concerning mining methods, facilities, hazardous materials, mitigation and monitoring requirements, etc. are the same as described for the Proposed Action.

As applied for, the LBA tract consists of a single block of federal coal (figure 1-3). BLM identified a study area to evaluate the potential that an alternate configuration of the tract would provide for more efficient recovery of the federal coal, increase competitive interest in the tract, and reduce the potential that some of the remaining unleased federal coal in this area would be bypassed in the future. The BLM study area includes the tract as applied for and unleased federal coal adjacent to the northern edge of the tract as applied for (figure 2-2). Under this alternative, BLM could add some or all of the adjacent lands to the tract or BLM could reduce the size of the tract, as discussed in section 2.0.

The area BLM is evaluating in addition to the tract as applied for includes the following lands:

T.46N., R.70W., 6th P.M., Campbell County, Wyoming

Section 18: Lots 7 through 10; 162.00 acres

The land description and acreage are based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plat as of August 8, 2006.

In identifying a study area, BLM included additional federal coal resources north of the current application area, as shown in figure 2-2. BLM evaluated that federal coal in order to determine if it would be possible to economically recover additional coal in this area. After evaluating the tract configuration, BLM concluded that economic considerations preclude extending the West Coal Creek LBA tract in a north direction to the full extent of the study area due to the presence of the Coal Creek Mine railroad spur. BLM did not reduce the size of the tract because the modified tract was configured to allow recovery of the federal coal while maintaining the setback distances necessary to avoid the railroad spur. BLM is considering the addition of approximately 81 acres to the northern portion of the tract. Although most of the coal included in this addition to the tract would not be recoverable due to the required setback distances, including this coal in the tract would allow more efficient recovery of the coal up to the required setback distance.

BLM's preferred tract configuration is to add approximately 81 acres to the northern edge of the tract as applied for (figure 2-2). Under Alternative 2, BLM would add the following lands to the West Coal Creek LBA tract as applied for:

T.46N., R.70W., 6th P.M., Campbell County, Wyoming

Section 18: Lots 9 and 10; 80.91 acres

The legal description of BLM's preferred configuration of the tract under Alternative 2 is as follows:

T.46N., R.70W., 6th P.M., Campbell County, Wyoming

Section 18: Lots 9 and 10, 14 through 17;	242.86 acres
Section 19: Lots 7 through 10, 15 through 18;	323.60 acres
Section 30: Lots 5 through 20.	665.71 acres
Total:	1,232.17 acres

The land description and acreage are based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plat as of August 8, 2006. The coal estate in the tract described above is federal and the surface estate is owned by Dennis Edwards and TBCC. Ownership of the oil and gas estate is discussed in section 3.11.

As mentioned previously, the coal in tract that was added under this alternative is not currently considered to be recoverable by ALC because of the presence of the Coal Creek Mine railroad spur ROW. The coal adjacent to and underlying the ROW is not considered to be recoverable at this time because the cost associated with moving the railroad spur would make it economically unfeasible to recover the underlying coal. There would also be a quantity of coal north of the railroad spur that would be isolated from the mining operations if the coal under the railroad was not mined. Although these lands would likely not be mined, they are included in the BLM study area to allow maximum recovery of all the mineable coal that is adjacent to but outside of the railroad spur ROW.

ALC estimates that under Alternative 2, the tract contains approximately 63.3 million tons of mineable coal reserves. Using ALC's projected recovery factor of 90 percent of the mineable coal reserves included in BLM's tract reconfiguration, the tract would contain about 57.0 million tons of recoverable coal. ALC estimates that at the projected average annual coal production rate of 13.4 mmtpy, mining this coal would extend this mine life by just over 4 years. As a basis for estimating impacts, annual production is assumed to increase to 14 mmtpy by 2015 and hold at that rate through 2020 and to the end of mine life.

BLM independently evaluates the volume and average quality of the coal resources included in the tract offered for sale as part of the fair market value determination process. That estimate may not agree with the estimates provided by the applicant. Under the Preferred Alternative (Alternative 2), BLM's estimate will be published in the sale notice for the tract, if it is offered for sale.

2.3 Alternatives for the Caballo West LBA Tract

2.3.1 Caballo West LBA Tract Proposed Action

Under the Proposed Action, the Caballo West LBA tract as applied for by CCC would be offered for lease at a sealed-bid, competitive lease sale, subject to

standard and special lease stipulations developed for the PRB (appendix D). The boundaries of the tract would be consistent with the tract configuration proposed in the Caballo West lease application (figure 2-3). The Proposed Action assumes that CCC would be the successful bidder on the tract if it is offered for sale.

The legal description of the proposed coal lease lands as applied for by CCC under the Proposed Action is as follows:

T. 48 N., R. 71 W., 6th P.M., Campbell County, Wyoming

Section 7: Lots 12, 19;	81.88 acres
Section 8: Lot 10;	39.67 acres
Section 17: Lots 1 through 10, 11 (N½, SE¼), 12 (NE¼), 15 (N½, SE¼), 16;	521.76 acres
Section 18: Lot 5, 12 (NE¼);	52.32 acres
Section 20: Lots 1, 2 (NE¼), 8 (N½, SE¼).	81.86 acres
Total:	777.49 acres

The land description and acreage are based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plat as of March 8, 2006. The ownership of the coal estate in the tract described above is federal and the surface estate is owned by the Paul D. Rourke Trust; James F. Rourke, et al.; and FCW. Ownership of the oil and gas estate is discussed in section 3.11.

CCC estimates that the Caballo West LBA tract includes approximately 98.2 million tons of in-place coal and that approximately 87.5 million tons of those in-place coal reserves are mineable. Using CCC's projected recovery factor of 93.5 percent of the mineable coal reserves, the tract as applied for would contain about 81.8 million tons of recoverable coal. At the estimated annual average coal production rate of 37.8 mmtpy, mining this coal would extend this mine life by just over 2 years. As a basis for estimating impacts, annual production is assumed to reach 39 mmtpy by 2015 and hold at that rate through 2020 to end of mine life. Future production rates are difficult to estimate since mines must increase or reduce rates in line with annual demand and competition for coal sales. BLM estimated future rates for the purpose of estimating impact using the *Task 2 report for the Powder River Basin Coal Review – Past and Present and Reasonably Foreseeable Development Activities* (BLM 2005a). This results in an average production rate from 2008 to the end of mine life of 37.8 mmtpy.

BLM independently evaluates the volume and average quality of the coal resources included in the tract offered for sale as part of the fair market value determination process. That estimate may not agree with the estimates provided by the applicant. BLM's estimate will be published in the sale notice for the tract if it is offered for sale.

The Caballo West LBA tract would be mined as an integral part of the Caballo Mine under the Proposed Action. Since this tract would be an extension of the existing mine, the facilities and infrastructure would be the same as those identified in the WDEQ/LQD Mine Permit 433 Term T5, approved July 23, 2003 and the BLM R2P2, which was approved May 26, 2006.

CCC's currently approved air quality permit from the WDEQ/AQD for the Caballo Mine allows up to 50 million tons of coal per year to be mined. The Caballo Mine produced:

- 27.1 million tons of coal in 2001,
- 26.0 million tons of coal in 2002,
- 22.7 million tons of coal in 2003,
- 26.5 million tons of coal in 2004,
- 30.5 million tons of coal in 2005,
- 32.7 million tons of coal in 2006, and
- 31.2 million tons of coal in 2007,

(Wyoming Department of Employment 2001, 2002, 2003, 2004, 2005, and 2006, CCC 2007).

Under the currently approved mining plan (No Action alternative), the remaining 584.8 million tons of recoverable coal reserves on the existing leases would be mined in approximately 15.4 years at an average production rate of approximately 37.8 mmtpy. CCC estimates that annual coal production would average approximately 37.8 million tons, mine life would be extended by about 2.2 additional years, and coal production at the Caballo Mine would continue for nearly 18 years beyond mid 2008.

If CCC acquires the Caballo West LBA tract as applied for, they estimate that a total of 666.6 million tons of coal would be recovered after July 1, 2008, with an estimated 81.8 million tons coming from the LBA tract. As of June 30, 2008, approximately 510.4 million tons of coal had been mined from within the current permit area of the Caballo Mine.

Prior to disturbance and in advance of mining, mine support structures such as roads, power lines, substations, and flood and sediment control measures would be built as needed. An estimated four overhead powerlines, one buried telephone line, and eight buried pipelines would require relocation prior to mining.

Topsoil removal with suitable heavy equipment, such as rubber-tired scrapers, would proceed ahead of overburden removal. Whenever possible, direct haulage to a reclamation area would be done but, due to scheduling, some topsoil would be temporarily stockpiled. As outlined in the reclamation plan, heavy equipment would be used to haul and distribute the stockpiled topsoil.

The Caballo Mine is one of several mines currently operating in the PRB where the coal seams are notably thick and the overburden is relatively thin. Mining would be conducted in two separate, semi-independent pits; one located primarily within the current permit area and one located primarily within the proposed lease area. The multi-pit concept has been and would be used to reduce operating costs by blending production from areas having different stripping ratios and coal quality, and also to help stabilize manpower requirements. Overburden removal has been and would continue to be conducted using trucks and shovels, draglines, and direct cast blasting. Other equipment used during overburden removal and backfilling would include dozers, scrapers, excavators, front-end loaders, graders, and water trucks. Most overburden and all coal have been and would continue to be drilled and blasted to facilitate efficient excavation. The design of the Caballo Mine seeks to confine disturbance to the active mine blocks. As overburden is removed, most would be placed into areas where coal has already been removed.

Chapter 4, Section 2(b)(i) of the WDEQ/LQD Coal Rules requires that rough backfilling and grading follow coal removal as closely as possible based on the mining conditions (WDEQ/LQD 2005a). According to a recent OSM evaluation of the Wyoming coal mining industry, the 2007 reclamation to disturbance ratio was approximately 80 percent (12,258 acres reclaimed vs. 15,321 acres disturbed) (OSM 2008). Replaced (backfilled) overburden is graded to approximate original land surface contour, as required by WDEQ and OSM rules. Elevations consistent with an approved PMT plan would be established as quickly as possible to construct a stable landscape and restore drainage. Backfilled and recontoured overburden is sampled and analyzed to verify suitability as subsoil. Material that is found to be unsuitable for reclamation (i.e., material that is not suitable for use in reestablishing vegetation or that may affect groundwater quality due to high concentrations of certain constituents, such as selenium or adverse pH levels) would either be removed and treated, or adequately covered with suitable overburden material prior to topsoiling. Under certain conditions, the PMT may not be immediately achievable. This occurs when excess material may require temporary stockpiling, when there is insufficient material available from current overburden removal operations, or when future mining could redisturb an already mined area.

Once a seedbed has been prepared, vegetation that is consistent with the post-mining land use would be reestablished. The reseeded area would be monitored to evaluate the success of revegetation growth and the variety of plant species for a minimum of 10 years before final reclamation bond release. WDEQ/LQD requires that mining companies post a bond on all mining disturbed acres within their permit boundary that would cover the cost of completing reclamation. In order to meet the conditions for final bond release, the reclamation must have vegetative cover, production and plant species diversity equal to a predetermined native comparison (reference) area. The reclaimed area must have a shrub density of one per square meter over 20 percent of the area. It must also support the post-mining land use (grazing and wildlife), as determined by grazing trials and by

monitoring of wildlife use on the reclamation. This lengthy period required for final bond release means that the total acres listed as reclaimed likely includes areas completely reclaimed and areas in various stages of being reclaimed.

Coal would be produced from one coal seam that CCC refers to as the Wyodak inside the mine permit area. The seam averages 62 feet thick inside the Caballo West LBA tract. Coal would be mined at several working faces to enable blending of the coal to meet customer quality requirements, to comply with BLM lease requirements for maximum economic recovery of the coal resource, and to optimize coal removal efficiency with available equipment. Coal would be loaded with electric-powered shovels into off-highway haul trucks for transport to crushing facilities. Coal haul roads would be temporary structures built within the mine areas. The Caballo Mine uses one existing coal crushing facility located within the mine permit area, which provides the capacity to produce at the permitted level. The truck dump is covered by a stilling shed for control of fugitive emissions. All coal crushing operations and conveying, transferring, and storage facilities are equipped with atomizer/fogger systems or baghouses for dust control. A system of transfer conveyors moves the prepared coal to interim storage in four concrete silos located adjacent to the unit train loadout facility. While sufficient storage capacity exists, future changes in facilities may be constructed to improve operating efficiency and air quality protection. For example, a covered slot storage barn, covered dome, or other appropriate storage structure may be built. A covered overland conveyor and near-pit crusher system may be constructed and moved as the mining operation progresses.

Full-time employment at the Caballo Mine is currently 549 persons. If CCC acquires the Caballo West LBA tract under the Proposed Action, employment levels would remain the same for the additional 2 years that it would take to mine the coal included in the tract. This assumes that the annual coal production rate would average approximately 37.8 mmtpy.

CCC applied for the tract, but the tract is also adjacent to the Belle Ayr Mine, operated by FCW (figure 1-4). As a result, FCW is in a position to mine the Caballo West LBA tract. If a company other than CCC were to acquire the tract, the rate of coal production, mining sequence, equipment, and facilities would be different than if CCC acquired the tract as a maintenance lease. However, the area of disturbance and the impacts of removing the coal would not be substantially different from the area of disturbance and the impacts of CCC mining the tract.

2.3.2 Caballo West LBA Tract Alternative 1

Under Alternative 1, the No Action alternative, CCC's application to lease the coal included in the tract would be rejected, the tract would not be offered for competitive sale at this time, and the coal included in the tract would not be mined. Under this alternative, the Caballo Mine would mine its remaining 584.8

million tons of recoverable coal reserves on the existing Caballo leases in approximately 15.4 years at an average production rate of approximately 37.8 mmtpy.

Rejection of the application would not affect permitted mining activity and employment at the Caballo Mine. The mine currently owns or leases approximately 11,704.5 acres of federal coal, 1,308.0 acres of private coal, and 160.1 acres of state coal; all of which are within the existing CCC mine permit boundary. A total of approximately 16,898.0 acres will eventually be affected in mining the current leases. If the Caballo West LBA tract is not leased, CCC estimates that the annual production at the Caballo Mine after July 1, 2008 will average 37.8 million tons, and the average full-time employment level is expected to remain near 549 persons.

In order to compare the economic and environmental consequences of mining these lands versus not mining them, this EIS was prepared under the assumption that the tract would not be mined in the foreseeable future if the No Action alternative is selected. However, selection of the No Action alternative would not preclude leasing and mining this tract in the future. If the decision is made to reject the Caballo West lease application at this time, the tract could be leased as a maintenance tract in the future while the adjacent mine is in operation. If it is not leased while the existing adjacent mine is in operation, it may or may not be leased in the future. This tract does not include enough coal reserves to economically justify mining by a new operation. However, the coal reserves included in the tract could be combined with unleased federal coal to the west to create a larger tract, which could be mined by a new operation in the future.

2.3.3 Caballo West LBA Tract Alternative 2

Under Alternative 2 for the Caballo West LBA tract, BLM would reconfigure the tract, hold one competitive coal sale for the lands included in the reconfigured tract, and issue a lease to the successful bidder. The modified tract would be subject to standard and special lease stipulations developed for the PRB and this tract if it is offered for sale (appendix D). Alternative 2, holding a competitive coal sale for a modified tract, is BLM's Preferred Alternative.

Alternative 2 assumes that CCC would be the successful bidder on the tract if a lease sale is held and that the tract would be mined as a maintenance lease for the Caballo Mine. Assumptions concerning mining methods, facilities, hazardous materials, mitigation and monitoring requirements, etc. are the same as described for the Proposed Action.

As applied for, the LBA tract consists of a single block of federal coal (figure 1-4). BLM identified a study area to evaluate the potential that an alternate configuration of the tract would provide for more efficient recovery of the federal coal, increase competitive interest in the Caballo West LBA tract, and reduce the

potential that some of the remaining unleased federal coal in this area would be bypassed in the future. The BLM study area includes the tract as applied for and unleased federal coal adjacent to the southwestern edge of the tract as applied for (figure 2-3). Under this alternative, BLM could add some or all of the adjacent lands to the tract or BLM could reduce the size of the tract, as discussed in section 2.0. The original BLM study area was redelineated on June 20, 2007 to describe the tract based on 10-acre aliquot parts rather than physical boundaries (Bishop Road). CCC was aware of and agreed to the change.

The area BLM is evaluating in addition to the tract as applied for includes the following lands:

T. 48 N., R. 71 W., 6th P.M., Campbell County, Wyoming

Section 17: Lots 11 (SW¼), 12 (NW¼, S½), 15 (SW¼);	51.42 acres
Section 18: Lot 12 (NW¼, S½), 13;	72.82 acres
Section 20: Lots 2 (NW¼, S½), 8 (SW¼);	41.02 acres
Section 21: Lots 11, 12.	81.25 acres
Total:	246.51 acres

The legal description of BLM's preferred configuration of the Caballo West LBA tract under Alternative 2 is as follows:

T. 48 N., R. 71 W., 6th P.M., Campbell County, Wyoming

Section 7: Lots 12, 19;	81.88 acres
Section 8: Lot 10;	39.67 acres
Section 17: Lots 1 through 12, 15, 16;	573.18 acres
Section 18: Lot 5, 12, 13;	125.14 acres
Section 20: Lots 1, 2, 8;	122.87 acres
Section 21: Lots 11, 12.	81.25 acres
Total:	1,023.99 acres

The land description and acreage are based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plat as of March 8, 2006. The coal estate in the tract described above is federal and the surface estate is owned by the Paul D. Rourke Trust; James F. Rourke, et al.; and FCW. Ownership of the oil and gas estate is discussed in section 3.11.

Some of the coal in the Caballo West LBA tract under this alternative is not currently considered to be mineable due to the presence of the Bishop Road (Campbell County Road 12). A portion of the road overlies some of the coal included in the tract under Alternative 2. As discussed in section 1.1, the Surface Mining Control and Reclamation Act prohibits mining within 100 feet on either

side of the right-of-way of any public road (43 CFR 3461). There would also be a quantity of coal south of Bishop Road that would be isolated from the mining operations if the coal under the road was not mined. The coal underlying the portion of Bishop Road, its ROW, and the estimated layback needed on both sides of the county road to safely recover the coal (including the 100-foot buffer zone) within the tract under Alternative 2 could be mined if the Campbell County Board of Commissioners (authorized agency) determines that the road can be moved [30 CFR 761.11(d)]. CCC is currently evaluating the feasibility of relocating the road. CCC estimates that approximately 33.3 million tons of in-place coal is included within and south of the ROW and associated layback on both sides of the county road that is within the LBA tract under Alternative 2.

The federal coal lands underlying the county road ROW and the adjacent buffer zone are included in the tract because that would allow maximum recovery of the mineable coal adjacent to but outside of the road rights-of-way and adjacent buffer zones if the road is not moved. It would also allow recovery of the coal under the road if it is moved. If a lease is issued for this tract, stipulations will be attached stating that no mining activity may be conducted within 100 feet of the road ROW until a permit to move the road is approved.

CCC estimates that the Caballo West LBA tract under Alternative 2 includes approximately 131.4 million tons of in-place coal. If the Bishop Road is moved, CCC estimates that the tract contains approximately 105.5 million tons of mineable coal reserves. CCC assumes that about 93.5 percent of that coal (about 98.6 million tons of coal) could be recovered from the tract, based on historical recovery practices. As a basis for estimating impacts, annual production is assumed to reach 39 mmtpy by 2015 and hold at that rate through 2020 to end of mine life. This results in an average production rate from 2008 to the end of mine life of 37.8 mmtpy.

CCC estimates that the Caballo West LBA tract under Alternative 2 includes approximately 98.1 million tons of mineable coal reserves, if the Bishop Road is not moved. Excluding the federal coal reserves within and south of the Bishop Road ROW and buffer zone and the coal within the layback area, CCC estimates that the Caballo West LBA tract under Alternative 2 contains. Using CCC's projected recovery factor of 93.5 percent of the mineable coal reserves included in BLM's tract reconfiguration, the tract would contain about 91.7 million tons of recoverable coal. CCC estimates that under Alternative 2 at the estimated average annual coal production rate of 37.8 mmtpy, mining this coal would extend this mine life by just over 2 years.

BLM independently evaluates the volume and average quality of the coal resources included in the tract offered for sale as part of the fair market value determination process. That estimate may not agree with the estimates provided by the applicant. BLM's estimate of the mineable federal coal reserves and average

quality of coal included in the tract under Alternative 2 will be published in the sale notice for the tract if it is offered for sale.

2.4 Alternatives for the Maysdorf II LBA Tract

2.4.1 Maysdorf II LBA Tract Proposed Action

Under the Proposed Action, the Maysdorf II LBA tract as applied for by CMC would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the PRB (appendix D). The boundaries of the tract would be consistent with the tract configuration proposed in the Maysdorf II lease application (figure 2-4). The Proposed Action assumes that CMC would be the successful bidder on the tract if it is offered for sale.

The tract is divided into two discrete parcels hereafter referred to as the northern and southern blocks. The legal description of the proposed Maysdorf II LBA tract coal lease lands as applied for by CMC under the Proposed Action is as follows:

T. 46 N., R. 71 W., 6th P.M., Campbell County, Wyoming

Section 4: Lots 8, 9, 16, 17;	163.79 acres
Section 5: Lots 5, 12, 13, 20;	165.03 acres
Section 9: Lots 6 through 8;	122.86 acres
Section 10: Lots 7 through 10;	162.62 acres
Section 11: Lots 13 through 16;	161.87 acres
Section 14: Lots 1 through 4;	161.69 acres
Section 15: Lots 1 through 4;	162.59 acres

T. 47 N., R. 71 W., 6th P.M., Campbell County, Wyoming

Section 7: Lots 6 through 11, 14 through 19;	490.18 acres
Section 17: Lots 1 through 15, and SW¼NW¼;	639.73 acres
Section 18: Lots 5 through 14, 19, 20;	481.50 acres
Section 20: Lots 1, 8, 9, 16;	154.31 acres
Section 21: Lots 4, 5, 12, 13;	157.66 acres
Section 28: Lots 4, 5, 12, 13;	165.80 acres
Section 29: Lots 1, 8, 9, 16;	164.45 acres
Section 32: Lots 1, 8, 9, 16;	162.94 acres
Section 33: Lots 4, 5, 12, 13;	164.64 acres

T. 47 N., R. 72 W., 6th P.M., Campbell County, Wyoming

Section 12: Lots 1 through 16;	647.10 acres
Section 13: Lots 1 through 8.	325.04 acres
Total:	4,653.80 acres

The land description and acreage are based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of June 9, 2005, August 18, 2005, and April 10, 2006. The coal estate in the tract described above is federally owned and the surface estate is owned by the United States of America (administered by BLM); CMC; Cordero Rojo, Inc. (CRI); the Norma Duvall Trust; Earl Thrush, et al.; Western Railroad Properties, Inc.; Tony Hayden; Keidel Family LP; and Foundation Wyoming Land Company. Ownership of the oil and gas estate is discussed in section 3.11.

Some of the coal in the Maysdorf II LBA tract as applied for is not currently considered to be mineable for various reasons. CMC estimates that approximately 1.6 million tons of in-place coal reserves included in the tract are located under the Burlington Northern Santa Fe and Union Pacific (BNSF & UP) railroad ROW and an appropriate mining related offset. The coal underlying the ROW and offset is not considered to be mineable because the cost associated with moving the railroad would make it economically unfeasible to recover the underlying coal.

A portion of Wyoming State Highway 59 and portions of the Haight Road (Campbell County Road 44) and the Hilight Road (Campbell County Road 52) overlie portions of the coal included in the tract. As discussed in section 1.1, the Surface Mining Control and Reclamation Act prohibits mining within 100 feet on either side of the ROW of any public road (43 CFR 3461). The coal underlying these areas, associated ROWs, and the 100-foot buffer zones within the tract could be mined if Wyoming Department of Transportation (WYDOT) and the Campbell County Board of Commissioners, the authorized agencies, determine that the road can be moved [30 CFR 761.11(d)]. CMC does not have plans to relocate the highway at this time, but they are evaluating the feasibility of relocating the county roads. CMC estimates that approximately 3.0 million tons of mineable coal are included within the Wyoming 59 ROW and associated 100-foot buffer zone that is within the LBA tract. Approximately 17 million tons of mineable coal are included within the ROWs of the two county roads and associated 100-foot buffer zones within the LBA tract according to CMC. This amount also includes coal that would be isolated from mining if the county roads are not moved.

The federal coal lands underlying the railroad ROW, Wyoming 59, the two county roads, their ROWS and the adjacent buffer zones are included in the tract because that would allow maximum recovery of the mineable coal adjacent to but outside of the railroad and road ROWs and adjacent buffer zones if they are not moved; and it would also allow recovery of the coal under these areas if they are moved. If a lease is issued for this tract, stipulations will be attached stating that no mining activity may be conducted within 100 feet of the road rights-of-way until permits to move the roads are approved.

In addition, a small portion of the Maysdorf II tract is located within a "no-coal" zone, where coal-forming sediments were either not deposited or were eroded away after deposition.

If the county roads are moved, CMC estimates that the Maysdorf II LBA tract as applied for includes approximately 504.2 million tons of in-place coal and approximately 499.7 million tons of mineable coal reserves. CMC assumes that about 90 percent of that coal (about 449.8 million tons) could be recovered from the tract based on historical recovery practices. As a basis for estimating impacts, annual production is assumed to reach 48 mmtpy by 2015 and hold at that rate through 2020 to end of mine life. Future production rates are difficult to estimate since mines must increase or reduce rates in line with annual demand and competition for coal sales. BLM estimated future rates for the purpose of estimating impact using the *Task 2 report for the Powder River Basin Coal Review Task 2 Report – Past and Present and Reasonably Foreseeable Development Activities* (BLM 2005a). This results in an average production rate from 2008 to the end of mine life of 46.3 mmtpy.

If the county roads are not moved, CMC estimates that the tract as applied for contains approximately 482.7 million tons of mineable coal reserves. About 90 percent of that coal (about 434.5 million tons) of coal could be recovered according to CMC. CMC estimates that at the projected average annual coal production rate of 46.3 mmtpy, mining this coal would extend this mine life by just over 9 years.

BLM independently evaluates the volume and average quality of the coal resources included in the tract offered for sale as part of the fair market value determination process. BLM's estimate of the mineable federal coal reserves and average quality of the coal included in the tract may not agree with the mineable coal reserve and coal quality estimates provided by the applicant. BLM's estimate of the mineable federal coal reserves and average quality of coal included in the tract will be published in the sale notice for the tract, if it is offered for sale.

Cordero Rojo Mine is comprised of the former Cordero Mine and the contiguous former Caballo Rojo Mine. CMC worked with WDEQ/LQD to consolidate the Cordero and Caballo Rojo mining permits into a single mining permit for the Cordero Rojo Mine. WDEQ/LQD approved the permit consolidation (Permit 237-T8) on March 26, 2007.

The Maysdorf II LBA tract would be mined as an integral part of the Cordero Rojo Mine under the Proposed Action. Since the tract would be an extension of the existing Cordero Rojo Mine, the facilities and infrastructure would be the same as those identified in the WDEQ/LQD Mine Permit 237-T8 and the BLM R2P2, which was approved April 24, 2003.

CMC's currently approved air quality permit from the WDEQ/AQD for the Cordero Rojo Mine allows up to 65 million tons of coal per year to be mined. The Cordero Rojo Complex (Cordero and Caballo Rojo combined) produced:

- 43.5 million tons of coal in 2001,
- 38.2 million tons of coal in 2002,
- 36.1 million tons of coal in 2003,
- 38.7 million tons of coal in 2004,
- 37.8 million tons of coal in 2005,
- 39.7 million tons of coal in 2006, and
- 40.5 million tons of coal in 2007

(Wyoming Department of Employment 2001, 2002, 2003, 2004, 2005, and 2006, CMC 2008).

Under the currently approved mining plan (No Action alternative), the Cordero Rojo Mine would mine its remaining 525.9 million tons of recoverable coal reserves on the existing leases in just over 11 years at an average production rate of approximately 46.3 mmtpy. Under the Proposed Action and if the roads are moved, CMC estimates that annual coal production would average approximately 46.3 million tons, mine life would be extended by nearly 10 additional years, and coal production at the mine would continue for over 21 years beyond mid 2008. If the road is not moved, CMC estimates that annual coal production would average approximately 46.3 million tons, mine life would be extended by just over 9 additional years, and coal production at the Cordero Rojo Mine would continue for nearly 21 years beyond mid 2008.

If CMC acquires the Maysdorf II LBA tract as applied for and if the roads are moved, they estimate that a total of 975.7 million tons of coal would be recovered after July 1, 2008, with an estimated 449.8 million tons coming from the LBA tract. As of June 30, 2008, approximately 769.3 million tons of coal had been mined from within the current permit area of the Cordero Rojo Mine.

If CMC acquires the tract as applied for and if the roads are not moved, they estimate that a total of 960.4 million tons of coal would be recovered after July 1, 2008, with an estimated 434.5 million tons coming from the LBA tract.

Prior to disturbance and in advance of mining, mine support structures such as roads, power lines, substations, and flood and sediment control measures would be built as needed. The Belle Fourche River runs south to north through the existing Cordero Rojo Mine and through a small portion of the southern block of the LBA tract. Approximately 6 miles of the natural channel have been diverted to date within the mine's current permit area. CMC would propose another diversion of the Belle Fourche River if they acquire a lease for the Maysdorf II LBA tract. It is assumed that overhead powerlines, buried telephone lines and buried pipelines will require relocation prior to mining. Site inventories are being performed to identify the significance of these structures.

Topsoil removal with suitable heavy equipment, such as rubber-tired scrapers, would proceed ahead of overburden removal. Whenever possible, direct haulage to a reclamation area would be done but, due to scheduling, some topsoil would be temporarily stockpiled. As outlined in the reclamation plan, heavy equipment again would be used to haul and distribute the stockpiled topsoil.

The Cordero Rojo Mine is one of several mines currently operating in the PRB where the coal seams are notably thick and the overburden is relatively thin. Mining would be conducted in three separate, semi-independent pits; all three are currently located within the current permit boundary and would progress into the proposed lease area. The multi-pit concept has been and would be used to reduce operating costs by blending production from areas having different stripping ratios and coal quality, and also to help stabilize manpower requirements. Overburden removal has been and would continue to be conducted using trucks and shovels, draglines, and/or direct cast blasting. Other equipment used during overburden removal and backfilling would include dozers, scrapers, excavators, front-end loaders, graders, and water trucks. Most overburden and all coal have been and would continue to be drilled and blasted to facilitate efficient excavation. The design of the Cordero Rojo Mine seeks to confine disturbance to the active mine blocks. As overburden is removed, most would be directly placed into areas where coal has already been removed.

Chapter 4, Section 2(b)(i) of the WDEQ/LQD Coal Rules requires that rough backfilling and grading follow coal removal as closely as possible based on the mining conditions (WDEQ/LQD 2005a). According to a recent OSM evaluation of the Wyoming coal mining industry, the 2007 reclamation to disturbance ratio was approximately 80 percent (12,258 acres reclaimed vs. 15,321 acres disturbed) (OSM 2008). Replaced (backfilled) overburden is graded to approximate original land surface contour, as required by WDEQ and OSM rules. Elevations consistent with an approved PMT plan would be established as quickly as possible to construct a stable landscape and restore drainage. Backfilled and recontoured overburden is sampled and analyzed to verify suitability as subsoil. Material that is found to be unsuitable for reclamation (i.e., material that is not suitable for use in reestablishing vegetation or that may affect groundwater quality due to high concentrations of certain constituents, such as selenium or adverse pH levels) would either be removed and treated, or adequately covered with suitable overburden material prior to topsoiling. Under certain conditions, the PMT may not be immediately achievable. This occurs when there is an excess of material that may require temporary stockpiling, when there is insufficient material available from current overburden removal operations, or when future mining could redisturb an area already mined.

Once a seedbed has been prepared, vegetation that is consistent with the post-mining land use would be reestablished. The reseeded area would be monitored to evaluate the success of revegetation growth and the establishment of a variety of plant species for a minimum of 10 years before final reclamation bond release.

WDEQ/LQD requires that mining companies post a bond on all mining disturbance acres within their permit boundary that would cover the cost of completing reclamation. In order to meet the conditions for final bond release, the reclamation must have vegetative cover and production and plant species diversity equal to a predetermined native comparison (reference) area. The reclaimed area must have a shrub density of one per square meter over 20 percent of the area. It must also support the post-mining land use (grazing and wildlife), as determined by grazing trials and by monitoring wildlife use on the reclamation. This lengthy period required for final bond release means that the total acres listed as reclaimed likely includes areas completely reclaimed and areas in various stages of being reclaimed.

Coal would be produced from one coal seam that CMC refers to as the Wyodak or the Wyodak-Anderson inside the mine permit area. Up to five noncoal splits or partings occur within the seam and they are typically local, discontinuous lenses of carbonaceous clay or shale that are less than 1 foot thick. The northern block of the Maysdorf II tract has a coal thickness of approximately 65 feet. The coal in the southern block is divided by a 2 foot parting with approximately 10 feet of coal above and 40 feet of coal below the parting.

Coal would be mined at several working faces to enable blending of the coal to meet customer quality requirements, to comply with BLM lease requirements for maximum economic recovery of the coal resource, and to optimize coal removal efficiency with available equipment. Coal would be loaded with electric-powered shovels into off-highway haul trucks for transport to crushing facilities. Coal haul roads would be temporary structures built within the mine areas. The Cordero Rojo Mine uses two existing coal crushing facilities located within the mine permit area: north pit facility and the south plant facility. Both are located within the old CMC mine permit area, which provides the capacity to produce at the permitted level. A haulroad was permitted and constructed in 1997 to provide a direct route between the two coal processing plant facilities. All coal crushing operations and conveying, transferring, and storage facilities are equipped with atomizer/fogger systems for dust control. There are six existing coal storage silos (two at the north facility and four at the south facility) and a covered storage slot. While sufficient storage capacity exists, future changes in facilities may be constructed to improve operating efficiency and air quality protection. For example, a covered slot storage barn, covered dome, or other appropriate storage structures may be built. In addition, a covered overland conveyor and near-pit crusher system may be constructed and moved as the mining operation progresses.

Full-time employment at the Cordero Rojo Mine is currently 510 persons. If CMC acquires the Maysdorf II LBA tract under the Proposed Action, they anticipate that employment levels would increase to 573 over the 10 additional years that it would take to mine the coal included in the tract. This assumes that the annual coal production rate would average approximately 46.3 mmtpy.

CMC applied for the tract, but the tract is also adjacent to the Belle Ayr Mine, operated by FCW (figure 1-5). As a result, FCW is in a position to mine a portion of the tract. If a company other than CMC was to acquire the tract, the rate of coal production, mining sequence, equipment, and facilities would be different than if CMC acquired the tract as a maintenance lease. However, the area of disturbance and the impacts of removing the coal would not be substantially different from the area of disturbance and the impacts of FCW mining the tract.

2.4.2 Maysdorf II LBA Tract Alternative 1

Under the No Action alternative, CMC's application to lease the coal included in the Maysdorf II LBA tract would be rejected, the tract would not be offered for competitive sale at this time, and the coal included in the tract would not be mined. Under this alternative, the Cordero Rojo Mine would mine its remaining 525.9 million tons of recoverable coal reserves on the existing Cordero Rojo leases in just over 11 years at an average production rate of approximately 46.3 mmtpy.

Rejection of the application would not affect permitted mining activity and employment at the Cordero Rojo Mine. The mine currently leases approximately 10,629 acres of federal coal, 2,000 acres of private coal, and 640 acres of state coal; all of which are within the existing mine permit boundaries. Approximately 14,694 acres will eventually be affected in mining the current leases. If the Maysdorf II LBA tract is not leased, CMC estimates that the annual production at the mine after January 1, 2008 will average 46.3 million tons, and the average full-time employment level is expected to remain near 510 persons.

In order to compare the economic and environmental consequences of mining these lands versus not mining them, this EIS assumes that the Maysdorf II LBA tract would not be mined in the foreseeable future under this alternative. However, selection of the No Action alternative would not preclude leasing and mining of this tract in the future. If the decision is made to reject the Maysdorf II lease application at this time, the tract could be leased as a maintenance lease in the future while the adjacent mine is in operation. If it is not leased while the existing adjacent mine is in operation, it may or may not be leased in the future. This tract is at the lower limits of having enough coal reserves to economically justify mining by a new operation; however, the coal reserves included in the tract could be combined with unleased federal coal to the west and south to create a larger tract, which could be mined by a new operation in the future.

2.4.3 Maysdorf II LBA Tract Alternative 2

Under Alternative 2 for the Maysdorf II LBA tract, BLM would reconfigure the tract, hold one competitive coal sale for the lands included in the reconfigured tract, and issue a lease to the successful bidder. The modified tract would be subject to standard and special lease stipulations developed for the PRB and this tract if it is offered for sale (appendix D).

Alternative 2 assumes that CMC would be the successful bidder on the tract if a lease sale is held and that the tract would be mined as a maintenance lease for the Cordero Rojo Mine. Assumptions concerning mining methods, facilities, hazardous materials, mitigation and monitoring requirements, etc. are the same as described for the Proposed Action.

As applied for, the tract consists of a two non-contiguous blocks of federal coal (figure 1-5). In order to evaluate the potential that an alternate configuration of the tract would provide for more efficient recovery of the federal coal, increase competitive interest in the Maysdorf II LBA tract, and reduce the potential that some of the remaining unleased federal coal in this area would be bypassed in the future, BLM identified a study area. The BLM study area includes the tract as applied for and unleased federal coal adjacent to the northern edge of the tract as applied for (figure 2-4). Under this alternative, BLM could add some or all of the adjacent land to the tract or BLM could reduce the size of the tract, as discussed in section 2.0.

The area BLM is evaluating in addition to the tract as applied for includes the following lands:

<u>T.47N., R.72W., 6th P.M., Campbell County, Wyoming</u>

Section 1: Lots 9 through 13, and NW¼SE¼;	241.80 acres

The legal description of BLM's reconfiguration of the tract under Alternative 2 is as follows:

<u>T. 46 N., R. 71 W., 6th P.M., Campbell County, Wyoming</u>

Section 4: Lots 8, 9, 16, 17;	163.79 acres
Section 5: Lots 5, 12, 13, 20;	165.03 acres
Section 9: Lots 6 through 8;	122.86 acres
Section 10: Lots 7 through 10;	162.62 acres
Section 11: Lots 13 through 16;	161.87 acres
Section 14: Lots 1 through 4;	161.69 acres
Section 15: Lots 1 through 4;	162.59 acres

<u>T. 47 N., R. 71 W., 6th P.M., Campbell County, Wyoming</u>

Section 7: Lots 6 through 11, 14 through 19;	490.18 acres
Section 17: Lots 1 through 15, and SW¼NW¼;	639.73 acres
Section 18: Lots 5 through 14, 19, 20;	481.50 acres
Section 20: Lots 1, 8, 9, 16;	154.31 acres
Section 21: Lots 4, 5, 12, 13;	157.66 acres
Section 28: Lots 4, 5, 12, 13;	165.80 acres
Section 29: Lots 1, 8, 9, 16;	164.45 acres

Section 32: Lots 1, 8, 9, 16;	162.94 acres
Section 33: Lots 4, 5, 12, 13;	164.64 acres

T. 47 N., R. 72 W., 6th P.M., Campbell County, Wyoming

Section 1: Lots 9 through 13, and NW¼SE¼;	241.80 acres
Section 12: Lots 1 through 16;	647.10 acres
Section 13: Lots 1 through 8.	325.04 acres
Total:	4,895.60 acres

The land description and acreage are based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of June 9, 2005, August 18, 2005, and April 10, 2006. The coal estate in the tract described above is federal and the surface estate is owned by the United States of America (administered by BLM); CMC; CRI; the Norma Duvall Trust; Earl Thrush, et al.; Western Railroad Properties, Inc.; Tony Hayden; Keidel Family LP; and Foundation Wyoming Land Company. Ownership of the oil and gas estate is discussed in section 3.11.

Some of the coal in the tract under this alternative is not currently considered to be mineable for various reasons. CMC estimates that approximately 1.6 million tons of in-place coal reserves included in the Maysdorf II LBA tract are located under the BNSF & UP railroad ROW and an appropriate safety offset. The coal underlying the ROW and offset is not considered to be mineable at this time because the cost associated with moving the railroad would make it economically unfeasible to recover the underlying coal.

A portion of Wyoming 59 and portions of the Haight Road (Campbell County Road 44) and the Hilight Road (Campbell County Road 52) overlie some of the coal included in the tract. As discussed in section 1.1, the Surface Mining Control and Reclamation Act prohibits mining within 100 feet on either side of the ROW of any public road (43 CFR 3461). The coal underlying the portions of the highway and county roads, their ROWs, and the 100-foot buffer zones within the Maysdorf II LBA tract could be mined if WYDOT and the Campbell County Board of Commissioners (authorized agencies) determine that the road can be moved [30 CFR 761.11(d)]. CMC does not have plans to relocate the highway at this time but they are evaluating the feasibility of relocating the county roads. CMC estimates that approximately 3.9 million tons of mineable coal are included within the highway ROW and associated 100 foot buffer zone within the LBA tract. Approximately 17 million tons of mineable coal are included within the ROWs of the two county roads and associated 100-foot buffer zones that are within the LBA tract according to CMC estimates.

The federal coal lands underlying the railroad, highway, county roads, and their rights-of-way and the adjacent buffer zones are included in the tract because that would allow maximum recovery of the mineable coal adjacent to but outside of

those areas whether or not the railroad and roads are moved. If a lease is issued for this tract, stipulations will be attached stating that no mining activity may be conducted within 100 feet of road ROWs until permits to move the roads are approved.

In addition, a small portion of the Maysdorf II tract is located within a "no-coal" zone, where coal-forming sediments were either not deposited or were eroded away after deposition.

If the county roads are moved, CMC estimates that under Alternative 2 the Maysdorf II LBA tract includes approximately 533.2 million tons of in-place coal and approximately 527.5 million tons of mineable coal reserves. About 90 percent of that coal (about 474.7 million tons) could be recovered based on historical recovery practices. As a basis for estimating impacts, annual production is assumed to reach 48 mmtpy by 2015 and hold at that rate through 2020 to end of mine life. This results in an average production rate from 2008 to the end of mine life of 46.3 mmtpy.

Under this alternative, if the county roads are not moved, CMC estimates that the tract includes approximately 533.2 million tons of in-place coal and approximately 510.5 million tons of mineable coal reserves. About 90 percent of that coal (about 459.5 million tons) could be recovered based on historical recovery practices. CMC estimates that at the projected average annual coal production rate of 46.3 mmtpy, mining this coal would extend this mine life by nearly 10 years.

BLM independently evaluates the volume and average quality of the coal resources included in the tract offered for sale as part of the fair market value determination process. BLM's estimate of the mineable federal coal reserves and average quality of the coal may not agree with the mineable coal reserve and coal quality estimates provided by the applicant. BLM's estimate of the mineable federal coal reserves and average quality of coal included in the tract will be published in the sale notice for the tract if it is offered for sale.

In addition to those described in the Proposed Action, sediment control measures needed under Alternative 2 would include measures for Caballo Creek. While Caballo Creek is outside of the BLM study area, it would likely be disturbed due to overstripping to allow coal to be removed from the north block. Approximately 3.6 miles of the natural channel have been diverted to date by FCW within the Belle Ayr Mine's current permit area. CMC would propose another diversion of Caballo Creek if they acquire a lease for the Maysdorf II LBA tract.

2.4.4 Maysdorf II LBA Tract Alternative 3

Under Alternative 3 for the Maysdorf II LBA tract, BLM is considering adding all or part of the BLM study area to the tract as applied for and dividing the revised tract into two tracts and offering one or both of those tracts for sale. Under this

alternative, BLM could add all, part, or none of the adjacent lands to the tract or reduce the size of the tract, as discussed in section 2.0. A separate, competitive sealed bid sale would be held for each tract that is offered for sale. Each tract would be subject to standard and special lease stipulations developed for the PRB and for that tract (appendix D). Alternative 3, as described above, is BLM's Preferred Alternative.

If one or both of the tracts are offered for lease, this alternative assumes that CMC would be the successful bidder and that the federal coal would be mined to extend the life of the existing Cordero Rojo Mine. Assumptions concerning mining methods, facilities, hazardous materials, mitigation and monitoring requirements, etc. would be the same as described for the Proposed Action.

As discussed under the Proposed Action and Alternative 2, the tract consists of two non-contiguous blocks of federal coal. Under Alternative 3, the North Maysdorf II LBA tract would consist of the northernmost one-half of the northern block of coal and the South Maysdorf II LBA tract would consist of the southern one-half of the northern block plus the southern block of coal (figure 2-4).

As previously discussed, BLM has identified a study area which includes the tract as applied for and unleased federal coal adjacent to the northern edge of the tract as applied for (figure 2-4). BLM is evaluating the potential that adding some or all of these lands to the area offered for lease would provide for more efficient recovery of the federal coal, increase competitive interest in the Maysdorf II LBA tract, and reduce the potential that some of the remaining unleased federal coal in this area would be bypassed in the future. Under this alternative, BLM could add all, part, or none of the adjacent lands to the tract or reduce the size of the tract, as discussed in section 2.0. The final delineation of the North Maysdorf II LBA tract will be made based on the outcome of any prior South Gillette Area tract sales that influence the competitive nature of the North Maysdorf II LBA. The lands that would be included in the north tract under Alternative 3 are:

T. 47 N., R. 71 W., 6th P.M., Campbell County, Wyoming

Section 7: Lots 6 through 11, 14 through 19;	490.18 acres
Section 17: Lots 1 through 15, and SW¼NW¼;	639.73 acres
Section 18: Lots 5 through 14, 19, 20;	481.50 acres

T. 47 N., R. 72 W., 6th P.M., Campbell County, Wyoming

Section 1: Lots 9 through 13, and NW¼SE¼;	241.80 acres
Section 12: Lots 1 through 16;	647.10 acres
Section 13: Lots 1 through 8;	325.04 acres
Total:	2,825.35 acres

The lands that would be included in the south tract under Alternative 3 are:

<u>T. 47 N., R. 71 W., 6th P.M., Campbell County, Wyoming</u>

Section 20: Lots 1, 8, 9, 16;	154.31 acres
Section 21: Lots 4, 5, 12, 13;	157.69 acres
Section 28: Lots 4, 5, 12, 13;	165.80 acres
Section 29: Lots 1, 8, 9, 16;	164.45 acres
Section 32: Lots 1, 8, 9, 16;	162.94 acres
Section 33: Lots 4, 5, 12, 13;	164.64 acres

<u>T. 46 N., R. 71 W., 6th P.M., Campbell County, Wyoming</u>

Section 4: Lots 8, 9, 16, 17;	163.79 acres
Section 5: Lots 5, 12, 13, 20;	165.03 acres
Section 9: Lots 6 through 8;	122.86 acres
Section 10: Lots 7 through 10;	162.62 acres
Section 11: Lots 13 through 16;	161.87 acres
Section 14: Lots 1 through 4;	161.69 acres
Section 15: Lots 1 through 4.	162.59 acres
Total:	2,070.28 acres

The land description and acreage are based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of June 9, 2005, August 18, 2005, and April 10, 2006. The coal estate in the tracts described above is federally owned and the surface estate is owned by the United States of America (administered by BLM); CMC; CRI; the Norma Duvall Trust; Earl Thrush, et al.; Western Railroad Properties, Inc.; Tony Hayden; Keidel Family LP; and Foundation Wyoming Land Company. Section 3.11 contains a discussion of ownership on the oil and gas estates.

Some of the coal in the North Maysdorf II LBA tract under this alternative is not currently considered to be mineable for various reasons. A portion of Wyoming State Highway 59 overlies some of the coal included in the north tract. As discussed in section 1.1, Surface Mining Control and Reclamation Act prohibits mining within 100 feet on either side of the ROW of any public road (43 CFR 3461). The coal underlying the portion of the highway, its ROW, and the 100-foot buffer zone within the tract study area could be mined if WYDOT (authorized agency) determines that the road can be moved [30 CFR 761.11(d)]. CMC does not have plans to relocate the highway. CMC estimates that within the ROW and associated 100-foot buffer zone, the North Maysdorf II LBA tract contains approximately 3.9 million tons of mineable coal.

Although these lands would not be mined, the federal coal lands underlying Wyoming 59, its ROW, and the adjacent buffer zone are included in the tract

because that would allow maximum recovery of the mineable coal adjacent to but outside of these areas whether or not the highway is moved. If a lease is issued for this tract, a stipulation stating that no mining activity may be conducted within 100 feet of the Wyoming 59 ROW until a permit to move the highway is approved will be attached.

Under Alternative 3, CMC estimates that the North Maysdorf II LBA tract contains approximately 326.4 million tons of in-place coal and that approximately 322.5 million tons of those in-place coal reserves are mineable. Using CMC's projected recovery factor of 90 percent of the mineable coal reserves, the BLM study area would contain about 290.2 million tons of recoverable coal. CMC estimates that at the projected average annual coal production rate of 46.3 mmtpy, mining this coal would extend this mine life by just over 6 years.

Some of the coal in South Maysdorf II LBA tract under this alternative is not currently considered to be mineable at this time. Under Alternative 3, CMC estimates that within the BNSF & UP railroad ROW, the South Maysdorf II LBA tract contains approximately 1.6 million tons of the mineable coal reserves. The coal underlying the ROW is not considered to be recoverable at this time because the cost that would be associated with moving the railroad would make it economically unfeasible to recover the underlying coal.

Portions of the two county roads (Haight and Hilight) overlie some of the coal included in the South Maysdorf II LBA tract. As discussed in chapter 1, section 1.1, the Surface Mining Control and Reclamation Act prohibits mining within 100 feet on either side of the ROW of any public road (43 CFR 3461). The coal underlying portions of the Haight and Hilight roads, their rights-of-way, and the 100-foot buffer zones could be mined if the Campbell County Board of Commissioners (authorized agency) determine that the road can be moved [30 CFR 761.11(d)]. CMC is evaluating the feasibility of relocating the county roads. They estimate that approximately 17 million tons of mineable coal are included within the county road ROWs and associated 100-foot buffer zones that are within the South Maysdorf II LBA tract.

The federal coal lands underlying the railroad, the Haight and Hilight roads, their ROWs and the adjacent buffer zones are included in the tract because that would allow maximum recovery of the mineable coal adjacent to but outside of those areas whether or not the railroad and roads are moved. If a lease is issued for this tract, stipulations will be attached stating that no mining activity may be conducted within 100 feet of road rights-of-way until permits to move the roads are approved.

In addition, a small portion of the South Maysdorf II study area under Alternative 3 is located within a "no-coal" zone, where coal-forming sediments were either not deposited or were eroded away after deposition.

If the county roads are moved, CMC estimates that the tract includes approximately 206.8 million tons of in-place coal and approximately 205.0 million tons of mineable coal reserves. About 90 percent (184.5 million tons) of coal could be recovered from the South Maysdorf II LBA tract, based on historical recovery practices. CMC estimates that at the projected average annual coal production rate of 46.3 mmtpy, mining this coal would extend this mine life by 4 years.

If the county roads are not moved, CMC estimates that under the South Maysdorf II LBA tract Alternative 3, the tract includes approximately 206.8 million tons of in-place coal and approximately 188.0 million tons of mineable coal reserves. About 90 percent of that coal (169.3 million tons) could be recovered from the South Maysdorf II LBA tract, based on historical recovery practices. CMC estimates that at the projected average annual coal production rate of 46.3 mmtpy, mining this coal would extend this mine life by nearly 4 years.

Under Alternative 3, CMC estimates that the annual coal production would average approximately 46.3 million tons, regardless of whether they acquire the Maysdorf II North Tract, the Maysdorf II South Tract, or both as maintenance leases for the Cordero Rojo Mine. The life of the mine would be extended by approximately 6 years, and the average number of employees would be approximately 518 persons if CMC acquires only the north tract. If CMC acquires only the Maysdorf II South tract as a maintenance lease, the life of the mine would be extended by approximately 4 years, and the average number of employees would be approximately 512 persons.

BLM independently evaluates the volume and average quality of the coal resources included in the tracts offered for sale as part of the fair market value determination process. BLM's estimate of the mineable federal coal reserves and average quality of the coal included in the tracts may not agree with the mineable coal reserve and coal quality estimates provided by the applicant. BLM's estimate will be published in the sale notice for the tracts if they are offered for sale.

Mine support structures needed under Alternative 3 would be similar to those needed under Alternative 2.

2.5 Alternatives Considered but Not Analyzed in Detail

2.5.1 New Mine Start

Under this alternative, as under the Proposed Actions and Alternatives 2 and 3, BLM would hold a separate, competitive, sealed-bid sale for the lands included in each LBA tract. This alternative assumed that the successful qualified bidder for a tract would be someone other than the applicant and that this bidder would plan to open a new mine to develop the coal resources in one or more of the LBA tracts (Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II).

A company or companies acquiring this coal for one or more new stand-alone mines would require considerable initial capital expenses to construct new surface facilities (offices, shops, warehouses, coal processing facilities, coal loadout facilities, and rail spurs), extensive baseline data collection, and development of new mining and reclamation plans. In addition, a company or companies acquiring this coal for one or more new start mines would have to compete for customers with established mines in a competitive market.

BLM currently estimates that a tract would need to include as much as 500 to 600 million tons of coal in order to attract a buyer interested in opening a new mine in the Wyoming PRB. This is based on several assumptions. First, it is assumed that an operator would need to construct facilities capable of producing 30 mmtpy in order to take advantage of the economies of scale offered by the coal deposits in the PRB. Secondly, it is assumed that 20 to 30 years of coal reserves would be needed to justify the expense of building the facilities described above. Given these assumptions, the Belle Ayr North, West Coal Creek, and Caballo West LBA tracts do not include sufficient coal resources to consider opening a new mine. It is unlikely that a company or companies would lease these LBA tracts in order to open a new mine. Even though the Maysdorf II LBA tract contains more than the estimated tons of coal to attract an interested buyer, it is unlikely that a company would undertake the expense of opening a new mine in the area.

The potential difficulty in obtaining an air quality permit is another issue that could discourage new mine starts in the PRB. A new mine would create a new source of air quality impacts. As discussed in chapter 3, the WDEQ/AQD administers a permitting program to assist the agency in managing the state's air resources. Under this program, anyone planning to construct, modify, or use a facility capable of emitting designated pollutants into the atmosphere must obtain an air quality permit to construct. Coal mines fall into this category.

In order to obtain a construction permit, an operator may be required to demonstrate that the proposed activities will not increase air pollutant levels above annual standards established by the Wyoming Air Quality Standards and Regulations, which can be found on the internet at http://deq.state.wy.us/aqd/standards.asp. From 2001 through 2006, there were 29 monitored exceedances of the 24-hour PM_{10} standard at seven operating mines in the Wyoming PRB. Nineteen of these exceedances occurred in 2001 and 2002, while two, three, five, and zero exceedances occurred in 2003, 2004, 2005, and 2006, respectively. In 2007, there were six exceedances at three operating PRB surface coal mines. None of the exceedances to date have occurred at the Belle Ayr, Coal Creek, Caballo, or Cordero Rojo mines. Although many of these exceedances have been attributed to high winds, concerns about future potential exceedances of the Nation Ambient Air Quality Standards (NAAQS) may make it more difficult for an operator planning on opening a new mine to demonstrate that new operations would not result in air pollution levels that are above annual Wyoming standards.

In view of the issues discussed above, development of new mines on one or more of the LBA tracts included in this EIS is considered unlikely and this alternative is not analyzed in detail in this EIS.

The environmental impacts of developing one or more new mines to recover the coal resources in one or more of these LBA tracts would be greater than under the Proposed Action, the No Action alternative, or Alternatives 2 or 3 because of the need for new facilities, new rail lines, new employment, and the creation of additional sources of particulates (dust). In the event that one or more lease sales are held and the applicants are not the successful bidder(s), the successful bidder(s) would be required to submit detailed mining and reclamation plans for approval before any of the tract(s) could be mined. This NEPA analysis would be reviewed and supplemented as necessary prior to approval of those mining and reclamation plans.

2.5.2 Delaying the Sale

Under this alternative, BLM would delay the sale of an LBA tract as applied for. The prices received for coal from the PRB have generally been increasing in recent years. If that trend continues, the bonus and royalty payments to the government might be higher if the tract is offered for sale later. Also, delaying the sale of one or more of the tracts would allow CBNG resources to be more completely recovered prior to mining. Under this alternative, it is assumed that a tract could be developed later as either a maintenance tract or a new start mine, depending on how long the sale was delayed.

There is no assurance at this time that delaying the sale would result in a higher coal price or a higher bonus bid. Coal shipments in Wyoming and other states were limited during much of 2005 because of damage to railroad tracks. These shipping constraints combined with increasing world energy demands and natural disasters in other parts of the country led to large increases in coal prices in 2005. Rail capacity increased in 2006 and prices have moderated in 2006 and 2007.

There are two major sources of revenue to state and federal governments from leasing and mining federal coal: 1) the competitive bonus bid paid at the time the coal is leased, and 2) federal and state royalties and taxes collected when the coal is sold.

If coal prices do increase, the fair market value of the coal resources in the LBA tracts could increase, which could result in an increased bonus bid if the coal is leased later. However, postponing a lease sale would not necessarily lead to higher royalty or tax income to the state and federal governments. Royalty and tax payments are the larger of the two revenue sources and they increase automatically when coal prices increase because they are collected at the time the coal is sold. They cannot be collected until the coal is leased and permitted, which takes several years. If leasing is delayed, by the time the coal is mined, the higher

coal prices may or may not persist. If the higher coal prices do persist, they may enable the coal lessee to negotiate longer term contracts at higher prices, which would result in longer term, higher royalty, and tax revenues. On the other hand, if an existing mine runs out of coal reserves before prices rise, it would have to shut down before additional coal could be leased and permitted for mining. Under this scenario, the fair market value of the coal could actually decrease because the added expense of reopening a mine or starting a new mine would have to be factored into the fair market value.

Other considerations include the value of leaving the mineable coal for future development versus the value of making low-sulfur coal available now, in anticipation of cleaner fuel sources being developed in the future. Continued leasing of PRB coal enables coal-fired power plants to meet CAA requirements without constructing new plants, revamping existing plants, or switching to existing alternative fuels, which may significantly increase power costs for individuals and businesses. If cleaner fuel sources are developed in the future, they could be phased in with less economic impact to the public.

A range of the potential future economic benefits of delaying leasing until coal prices rise could be quantified in an economic analysis, but the benefits would have to be discounted to the present, which would make them similar to the Proposed Action and Alternatives 2 and 3.

CBNG resources are currently being recovered from oil and gas leases on all four LBA tracts. There are several mechanisms in place that can be used to allow continuing recovery of the CBNG resources prior to mining if the federal coal in the tracts is leased now. These include:

- BLM can attach a Multiple Mineral Development stipulation to each lease. This gives BLM the authority to withhold approval of coal mining operations that would interfere with the development of mineral leases issued prior to the coal lease.

- Mining of each LBA tract cannot occur until the coal lessee has a permit to mine the tract approved by the WDEQ/LQD and a Mineral Leasing Act of 1920 (MLA) mining plan approved by the Secretary of the Interior. Before the MLA mining plan can be approved, BLM must approve the R2P2 for mining the tract. Prior to approving the R2P2, BLM can review the status of CBNG development on the tract and the mining sequence proposed by the coal lessee. The permit approval process generally takes the coal lessee several years. This would allow time for a large portion of the CBNG resources to be recovered from each tract.

- BLM has a policy in place on CBNG-coal conflicts (BLM Instruction Memorandum No. 2006-153) that directs BLM decision makers to optimize

the recovery of both resources and ensure that the public receives a reasonable return (BLM 2006a).

This alternative was not analyzed in detail because it would not produce substantially different impacts from other alternatives analyzed in detail. Rental and royalty provisions in each proposed lease provide for the U.S. to benefit if coal prices increase by the time of mining. Moreover, recovery of a large portion of the economically-recoverable CBNG resources on the tracts would be anticipated after lease issuance because of the mechanisms discussed above. The environmental impacts of mining the coal later as part of an existing mine would be expected to be similar and about equal to the Proposed Action and Alternatives 2 and 3 for each LBA tract. If a new mine is required to mine the coal, the environmental impacts would be expected to be greater than if each tract were mined as an extension of an existing mine.

2.6 Regulatory Compliance, Mitigation, and Monitoring

SMCRA and Wyoming State law require surface coal mines to collect extensive baseline information and implement extensive monitoring programs and mitigation measures. The currently approved permits to conduct mining operations for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines include these requirements. Monitoring programs and mitigation measures that are required by regulation are considered part of the Proposed Action and the action alternatives considered in this EIS for the tracts. These data collection requirements, mitigation plans, and monitoring plans are in place for the No Action alternative as part of the current approved mining permit for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines. These requirements would be extended to include mining operations on the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts if they are leased and permitted for mining. A mining and reclamation plan would have to be approved for each tract before mining would be permitted regardless of who acquires the tract. The major mitigation and monitoring measures that are required by state or federal regulation are summarized in table 2-1. More specific information about some of these mitigation and monitoring measures and their results at each mine are described in chapter 3.

If impacts are identified during the leasing process that are not mitigated by existing required mitigation measures, BLM can require additional mitigation measures in the form of stipulations on the new lease, within the limits of its regulatory authority. In general, the levels of mitigation and monitoring required for surface coal mining by SMCRA and Wyoming State law are more extensive than those required for other surface disturbing activities; however, concerns are periodically identified that are not monitored or mitigated under existing procedures.

Table 2-1. Regulatory Compliance, Mitigation and Monitoring Measures for Surface Coal Mining Operations Required by SMCRA and State Law for all Alternatives.

Resource	Regulatory Compliance or Mitigation Required by Stipulations, State or Federal Law[1]	Monitoring[1]
Topography & Physiography	Restoring to approximate original contour or other approved topographic configuration.	WDEQ/LQD checks as-built vs. approved topography with each annual report.
Geology & Minerals	Identifying & selectively placing or mixing chemically or physically unsuitable overburden materials to minimize adverse effects to vegetation or groundwater.	WDEQ/LQD requires monitoring in advance of mining to detect unsuitable overburden.
Soils	Salvaging soil suitable to support plant growth for use in reclamation; Protecting soil stockpiles from disturbance and erosional influences; Selectively placing at least four feet of suitable overburden on the graded backfill surface below replaced topsoil to meet guidelines for vegetation root zones.	Monitoring vegetation growth on reclaimed areas to determine need for soil amendments; Sampling regraded overburden for compliance with root zone criteria.
Air Quality	Dispersion modeling of mining plans for annual average particulate pollution impacts on ambient air; Using particulate pollution control technologies; Using work practices designed to minimize fugitive particulate emissions; Using EPA- or state-mandated BACT, including: Fabric filtration or wet scrubbing of coal storage silo and conveyor vents, Watering or using chemical dust suppression on haul roads and exposed soils, Containment of truck dumps and primary crushers, Covering of conveyors, Prompt revegetation of exposed soils, High efficiency baghouse dust collection systems or PECs, or atomizers/foggers on the crusher, conveyor transfer, storage bin and train loadout, meeting a standard of 0.01 grains per dry standard cubic foot (dscf) of exit volume, Watering of active work areas, Reclamation plan to minimize surface disturbances subject to wind erosion, Paving of access roads, Haul truck speed limits, Limited material drop heights for shovels and draglines.	On-site air quality monitoring for PM_{10} and/or TSP; Off-site ambient monitoring for PM_{10} and/or TSP; On-site compliance inspections.

[1] These requirements, mitigation plans, and monitoring plans are in place for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines in their current approved mining and reclamation plans (the No Action alternatives). If the tracts were leased, these requirements, mitigation plans, and monitoring plans would be part of mining plan revisions covering the tracts that must be approved before mining can occur on the tracts under the Proposed Action and Alternatives.

Table 2-1. Regulatory Compliance, Mitigation and Monitoring Measures for Surface Coal Mining Operations Required by SMCRA and State Law for all Alternatives (Continued).

Resource	Regulatory Compliance or Mitigation Required by Stipulations, State or Federal Law[1]	Monitoring[1]
Air Quality (continued)	Following voluntary and required measures to avoid exposing the public to NO_2 from blasting clouds, including: Phone notification of neighbors and workers prior to blasting, Monitoring weather and atmospheric conditions prior to decisions to blast, Timing blasts to avoid temperature inversions and to minimize inconvenience to neighbors, Closing public roads when appropriate to protect the public, Minimizing blast sizes, Posting signs on major public roads.	
Surface Water	Building and maintaining sediment control ponds or other devices during mining; Restoring approximate original drainage patterns during reclamation; Restoring stock ponds and playas during reclamation.	Monitoring storage capacity in sediment ponds; Monitoring quality of discharges; Monitoring streamflow and water quality.
Groundwater Quantity	Evaluating cumulative impacts to water quantity associated with proposed mining; Replacing existing water rights that are interrupted, discontinued, or diminished by mining with water of equivalent quantity.	Monitoring wells track water levels in overburden, coal, interburden, underburden, and backfill.
Groundwater Quality	Evaluating cumulative impacts to water quality associated with proposed mining; Replacing existing water rights that are interrupted, discontinued, or diminished by mining with water of equivalent quality.	Monitoring wells track water quality in overburden, coal, interburden, underburden, and backfill.
Alluvial Valley Floors	Identifying all AVFs that would be affected by mining; Determining significance to agriculture of all identified AVFs affected by mining (WDEQ); Protecting downstream AVFs during mining; Restoring essential hydrologic function of all AVFs affected by mining.	Monitoring to determine restoration of essential hydrologic functions of any declared AVF.
Wetlands	Identifying all wetlands that would be affected by mining; Identifying jurisdictional wetlands (COE); Replacing all jurisdictional wetlands that would be disturbed by mining; Replacing functional wetlands as required by surface managing agency, surface landowner, or WDEQ/LQD.	Monitoring of reclaimed wetlands using same procedures used to identify pre-mining jurisdictional wetlands.

[1] These requirements, mitigation plans, and monitoring plans are in place for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines in their current approved mining and reclamation plans (the No Action alternatives). If the tracts were leased, these requirements, mitigation plans, and monitoring plans would be part of mining plan revisions covering the tracts that must be approved before mining can occur on the tracts under the Proposed Action and Alternatives.

Table 2-1. Regulatory Compliance, Mitigation and Monitoring Measures for Surface Coal Mining Operations Required by SMCRA and State Law for all Alternatives (Continued).

Resource	Regulatory Compliance or Mitigation Required by Stipulations, State or Federal Law[1]	Monitoring[1]
Vegetation	Permanently revegetating reclaimed areas according to a comprehensive revegetation plan using approved permanent reclamation seed mixtures consisting predominantly of species native to the area; Reclaiming 20 percent of reclaimed area with native shrubs at a density of one per square meter; Controlling erosion on reclaimed lands prior to seeding with final seed mixture using mulching, cover crops, or other approved measures; Chemically and mechanically controlling weed infestation; Direct hauling of topsoil; Selectively planting shrubs in riparian areas; Planting sagebrush; Creating depressions and rock piles; Using special planting procedures around rock piles; Posting reclamation bond covering the cost of reclamation.	Monitoring of revegetation growth & diversity until release of final reclamation bond (minimum 10 years); Monitoring of erosion to determine need for corrective action during establishment of vegetation; Use of controlled grazing during revegetation evaluation to determine suitability for post-mining land uses.
Wildlife and Sensitive Species	Restoring pre-mining topography to the maximum extent possible; Planting a diverse mixture of grasses, forbs, and shrubs in configurations beneficial to wildlife; Designing fences to permit wildlife passage; Raptor-proofing power transmission poles; Using raptor-safe power lines Creating artificial raptor nest sites; Increasing habitat diversity by creating rock clusters and shallow depressions on reclaimed land; Cottonwood plantings along reclaimed drainages; Replacing drainages, wetlands, and AVFs disturbed by mining; Reducing vehicle speed limits to minimize mortality; Instructing employees not to harass or disturb wildlife; Following approved raptor mitigation plans. Avoiding bald eagle disturbance; Restoring bald eagle foraging areas disturbed by mining; Restoring mountain plover habitat disturbed by mining; Surveying for mountain plover; Surveying for black-tailed prairie dog.	Baseline and annual wildlife monitoring surveys; Monitoring for Migratory Bird Species of Management Concern in Wyoming.

1 These requirements, mitigation plans, and monitoring plans are in place for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines in their current approved mining and reclamation plans (the No Action alternatives). If the tracts were leased, these requirements, mitigation plans, and monitoring plans would be part of mining plan revisions covering the tracts that must be approved before mining can occur on the tracts under the Proposed Action and Alternatives.

Table 2-1. Regulatory Compliance, Mitigation and Monitoring Measures for Surface Coal Mining Operations Required by SMCRA and State Law for all Alternatives (Continued).

Resource	Regulatory Compliance or Mitigation Required by Stipulations, State or Federal Law[1]	Monitoring[1]
Threatened, Endangered, Proposed, and Candidate Species	Surveying for Ute ladies'-tresses; Searching for black-footed ferrets if prairie dog colonies are on or move onto tract; Same as Wildlife Resource and Sensitive Species above.	Baseline and annual wildlife monitoring surveys.
Land Use	Suitably restoring reclaimed area for historic uses (grazing and wildlife);	Monitoring of controlled grazing prior to bond release evaluation.
Cultural Resources	Conducting Class I & III surveys to identify cultural properties on all state and federal lands and on private lands affected by federal undertakings; Consulting with the Wyoming State Historic Preservation Office (SHPO) to evaluate eligibility of cultural properties for the National Register of Historic Places (NRHP); Avoiding or recovering data from significant cultural properties identified by surveys, according to an approved plan; Notifying appropriate federal personnel if historic or prehistoric materials are uncovered during mining operations; Instructing employees of the importance of and regulatory obligations to protect cultural resources.	Monitoring of mining activities during topsoil stripping; cessation of activities and notification of authorities if unidentified sites are encountered during topsoil removal.
Native American Concerns	Notifying Native American tribes with known interest in this area of leasing action and requesting help in identifying potentially significant religious or cultural sites.	No specific monitoring program.
Paleontological Resources	Notifying appropriate federal personnel if potentially significant paleontological sites are discovered during mining.	No specific monitoring program.
Visual Resources	Restoring landscape character during reclamation through return to approximate original contour and revegetation with native species.	No specific monitoring program.
Noise	Protecting employees from hearing loss.	MSHA inspections.
Transportation Facilities	Relocating existing pipelines, if necessary, in accordance with specific agreement between pipeline owner and coal lessee.	No specific monitoring program.
Socioeconomics	Paying royalty and taxes as required by federal, state, and local regulations. No mitigation measures are proposed.	Surveying and reporting to document volume of coal removed.

[1] These requirements, mitigation plans, and monitoring plans are in place for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines in their current approved mining and reclamation plans (the No Action alternatives). If the tracts were leased, these requirements, mitigation plans, and monitoring plans would be part of mining plan revisions covering the tracts that must be approved before mining can occur on the tracts under the Proposed Action and Alternatives.

Table 2-1. Regulatory Compliance, Mitigation and Monitoring Measures for Surface Coal Mining Operations Required by SMCRA and State Law for all Alternatives (Continued).

Resource	Regulatory Compliance or Mitigation Required by Stipulations, State or Federal Law[1]	Monitoring[1]
Hazardous & Solid Waste	Disposing of solid waste and sewage within permit boundaries according to approved plans; Storing and recycling waste oil; Maintaining of files containing Material Safety Data Sheets for all chemicals, compounds, and/or substances used during course of mining; Ensuring that all production, use, storage, transport, and disposal of hazardous materials is in accordance with applicable existing or hereafter promulgated federal, state, and government requirements; Complying with emergency reporting requirements for releases of hazardous materials as established in CERCLA, as amended; Preparing and implementing spill prevention control and countermeasure plans, spill response plans, inventories of hazardous chemical categories pursuant to Section 312 of SARA, as amended; Preparing emergency response plans.	No special monitoring other than required by these other regulations and response plans.

[1] These requirements, mitigation plans, and monitoring plans are in place for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines in their current approved mining and reclamation plans (the No Action alternatives). If the tracts were leased, these requirements, mitigation plans, and monitoring plans would be part of mining plan revisions covering the tracts that must be approved before mining can occur on the tracts under the Proposed Action and Alternatives.

2.7 Hazardous and Solid Waste

Under the Proposed Action and action alternatives for each LBA tract, the procedures and requirements for handling hazardous and solid wastes would be the same as the procedures and requirements for the existing mining operations. Solid waste that is produced at the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines consists of floor sweepings, shop rags, empty lubricant containers, welding rod ends, metal shavings, worn tires, packing material, used filters, and office and food wastes. A portion of the solid wastes produced at the mines is disposed of within the mines' permit boundaries in accordance with WDEQ-approved solid waste disposal plans. Solid waste from the Belle Ayr, Caballo, and Cordero Rojo mines is also disposed of at the Campbell County landfill. Sewage is handled by WDEQ-permitted sewage systems present at the existing mine facilities. Maintenance and lubrication of most of the equipment takes place at shop facilities at the mines. Major lubrication, oil changes, etc. of most equipment are performed inside the service building lubrication bays at the four mines, where used oil and grease are contained and deposited in storage tanks. All of the collected used oils and grease are then recycled off site or used for energy recovery, including, at some of the mines, blending with diesel fuel oil for use as equipment fuel. These practices would not change if the applicants acquire the LBA tracts.

FCW, TBCC, CCC and CMC have reviewed the EPA's *Consolidated List of Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Reauthorization Act* (SARA) *of 1986* (as amended) and EPA's *List of Extremely Hazardous Substances* as defined in 40 CFR 355 (as amended) for hazardous substances used at their mining operations.

FCW, TBCC, CCC, and CMC maintain files containing Material Safety Data Sheets for all chemicals, compounds, and substances that are or would be used during mining. FCW, TBCC, CCC, and CMC are responsible for ensuring that all production, use, storage, transport, and disposal of hazardous and extremely hazardous materials because of mining are in accordance with all applicable existing or hereafter promulgated federal, state, and local government rules, regulations, and guidelines. All mining activities involving the production, use, and disposal of hazardous or extremely hazardous materials are and would continue to be conducted so as to minimize potential environmental impacts.

FCW, TBCC, CCC, and CMC must comply with emergency reporting requirements for release of hazardous materials. Any release of hazardous or extremely hazardous substances in excess of the reportable quantity (40 CFR 117), is reported as required by Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended. The materials for which such notification must be given are the extremely hazardous substances listed in Section 302 of the Emergency Planning and Community Right to Know Act and the hazardous substances designated under Section 102 of CERCLA, as amended.

If a reportable quantity of a hazardous or extremely hazardous substance is released, immediate notice must be given to the WDEQ Emergency Response Coordinator.

Each mining company is expected to prepare and implement several plans and/or policies to ensure environmental protection from hazardous and extremely hazardous materials. These plans/policies include:

- Spill Prevention Control and Countermeasure plans;
- Spill Response plans;
- Stormwater Pollution Prevention plans;
- Inventories of Hazardous Chemical Categories Pursuant to Section 313 of the Superfund Amendments and Re-authorization Act (SARA) of 1986, as Amended; and
- Emergency Response plans.

All mining operations are also required to be in compliance with regulations promulgated under the Resource Conservation and Recovery Act, Federal Water Pollution Control Act (Clean Water Act), Safe Drinking Water Act, Toxic Substances Control Act, Mine Safety and Health Act, Department of Transportation, and the Federal Clean Air Act. In addition, mining operations must comply with all attendant state rules and regulations relating to hazardous material reporting, transportation, management, and disposal.

Compliance with these rules is the current practice at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines. Acquisition of the LBA tracts by the applicants would not change these current practices nor the type and quantity of any wastes generated and disposed of by the mines.

2.8 Summary of Alternatives and Environmental Consequences

2.8.1 Background

The decision-making process for public lands in Wyoming is conducted in compliance with NEPA, which requires all federal agencies to involve interested publics in their decision-making, consider reasonable alternatives to the proposed actions, develop measures to mitigate environmental impacts, and prepare environmental documents that disclose the impacts of proposed actions and alternatives.

This EIS analyzes in detail different alternatives for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts described in the discussion above.

2.8.2 Summary of Alternatives

The Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts under the Action alternatives are shown on figures 2-1 through 2-4, respectively. A summary comparison of projected coal production, surface disturbance, mine life, and federal and state revenues for the alternatives for the tracts are presented in tables 2-2 through 2-8, respectively.

Table 2-9 presents a comparative summary of the direct and indirect environmental impacts of implementing each alternative as compared to the No Action alternative for all four LBA tracts. Each No Action alternative assumes completion of currently permitted mining at the applicant mine compared to anticipated mining if the associated LBA tract is leased. Table 2-10 compares the cumulative environmental impacts of implementing each alternative for the four LBA tracts. The environmental consequences of the Proposed Action and Alternatives 2 and 3 are analyzed in chapters 3 and 4. These summary impact tables are derived from the following explanation of impacts and magnitude. NEPA requires all agencies of the federal government to include, in every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on:

- (i) the environmental impact of the Proposed Action,
- (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,
- (iii) alternatives to the Proposed Action,
- (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
- (v) any irreversible and irretrievable commitments of resources which would be involved in the Proposed Action should it be implemented (42 USC § 4332[C]).

Impacts can be beneficial or adverse, and they can be a primary result of an action (direct) or a secondary result (indirect). They can be permanent, long-term (persisting beyond the end of mine life and reclamation) or short-term (persisting during mining and reclamation and through the time the reclamation bond is released). Impacts also vary in terms of significance. The basis for conclusions regarding significance are the criteria set forth by the Council on Environmental Quality (40 CFR 508.27) and the professional judgment of the specialists doing the analyses. Impact significance may range from negligible to substantial; impacts can be significant during mining but reduced to insignificant following completion of reclamation.

Table 2-2. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for Belle Ayr North LBA Tract and Belle Ayr Mine if the Bishop Road (Campbell County Road 12) is Moved and the Underlying Coal is Recovered.

Item	No Action Alternative (Existing Belle Ayr Mine)	Added by Proposed Action	Added by Alternative 2 (Preferred Alternative)
In-Place Coal (as of 6/30/08)	250.9 mmt	208.1 mmt	221.1 mmt
Mineable Coal (as of 6/30/08)	250.9 mmt	204.2 mmt	217.6 mmt
Recoverable Coal (as of 6/30/08)[1]	235.8 mmt	191.9 mmt	204.6 mmt
Coal Mined (as of 6/30/08)	544.5 mmt	—	—
Lease Area[2]	4,945.5 ac	1,578.7 ac	1,671.0 ac
Total Area To Be Disturbed[2]	11,621 ac	1,936.6 ac	1,947.0 ac
Permit Area[2]	11,935 ac	1,727 ac	1,818 ac
Current Air Quality Permitted Production	45.0 mmt	0 mmt	0 mmt
Average Annual Post-2007 Coal Production	30.0 mmt	0 mmt	0 mmt
Remaining Life of Mine (post-2007)	8.3 yrs	6.4 yr	6.8 yr
Average Number of Employees	358	8	8
Total Projected State Revenues (post-2007)[3]	$382.9 million	$342.2 – $410.7 million	$364.9 - $437.8 million
Total Projected Federal Revenues (post-2007)[4]	$283.6 million	$261.5 – $329.9 million	$278.7 - $351.6 million

1 Assumes 94 percent recovery of mineable coal.

2 The lease area includes federal coal leases only and does not include state and private coal within the permit boundary. The disturbed area exceeds the leased area (total federal, state and private) because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

3 Revenues to the state of Wyoming include severance taxes, property and production (Ad Valorum) taxes, sales and use taxes, and Wyoming's share of federal royalty payments, AML fees, and bonus bids. State revenues are based on $0.4312 per ton estimate for severance taxes × amount of recoverable coal, plus $0.372 per ton estimate for Ad Valorum taxes × amount of recoverable coal, plus $0.0569 per ton estimate for sales and use taxes × amount of recoverable coal, plus $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus federal's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus federal's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus federal's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution to states.

4 Federal revenues include black lung taxes and the federal government's share of federal royalty payments, AML fees, and bonus bids. Federal revenues are based on $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × black lung tax of 4.40 percent, plus $9.98 per ton (for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus state's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus state's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus state's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution to the federal government.

Table 2-3. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for Belle Ayr North LBA Tract and Belle Ayr Mine if the Bishop Road (Campbell County Road 12) is Not Moved and the Underlying Coal is Not Recovered.

Item	No Action Alternative (Existing Belle Ayr Mine)	Added by Proposed Action	Added by Alternative 2 (Preferred Alternative)
In-Place Coal (as of 6/30/08)	250.9 mmt	208.1 mmt	221.1 mmt
Mineable Coal (as of 6/30/08)	250.9 mmt	164.7 mmt	159.6 mmt
Recoverable Coal (as of 6/30/08)[1]	235.8 mmt	154.8 mmt	150.1 mmt
Coal Mined (as of 6/30/08)	544.5 mmt	—	—
Lease Area[2]	4,945.5 ac	1,578.7 ac	1,671.0 ac
Total Area To Be Disturbed[2]	11,621 ac	1,274.9 ac	1,658.4 ac
Permit Area[2]	11,935 ac	1,727 ac	1,818 ac
Current Air Quality Permitted Production	45.0 mmt	0 mmt	0 mmt
Average Annual Post-2007 Coal Production	30.0 mmt	0 mmt	0 mmt
Remaining Life of Mine (post-2007)	8.3 yrs	5.2 yr	5.0 yr
Average Number of Employees	358	8	8
Total Projected State Revenues (post-2007)[3]	$382.9 million	$276.1 – $331.3 million	$267.7 - $321.1 million
Total Projected Federal Revenues (post-2007)[4]	$283.6 million	$210.9 – $266.1 million	$204.5 - $258.0 million

1 Assumes 94 percent recovery of mineable coal. This table excludes all coal that is beneath the Bishop County Road ROW.

2 The lease area includes federal coal leases only and does not include state and private coal within the permit boundary. The disturbed area exceeds the leased area (total federal, state and private) because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

3 Revenues to the state of Wyoming include severance taxes, property and production (Ad Valorum) taxes, sales and use taxes, and Wyoming's share of federal royalty payments, AML fees, and bonus bids. State revenues are based on $0.4312 per ton estimate for severance taxes × amount of recoverable coal, plus $0.372 per ton estimate for Ad Valorum taxes × amount of recoverable coal, plus $0.0569 per ton estimate for sales and use taxes × amount of recoverable coal, plus $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus federal's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus federal's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus federal's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution to states.

4 Federal revenues include black lung taxes and the federal government's share of federal royalty payments, AML fees, and bonus bids. Federal revenues are based on $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × black lung tax of 4.40 percent, plus $9.98 per ton (for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus state's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus state's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus state's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution to the federal government.

Table 2-4. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for West Coal Creek LBA Tract and Coal Creek Mine.

Item	No Action Alternative (Existing Coal Creek Mine)	Added by Proposed Action	Added by Alternative 2 (Preferred Alternative)
In-Place Coal (as of 6/30/08)	241.7 mmt	63.3 mmt	69.3 mmt
Mineable Coal (as of 6/30/08)	241.7 mmt	63.3 mmt	63.3 mmt
Recoverable Coal (as of 6/30/08)[1]	217.5 mmt	57.0 mmt	57.0 mmt
Coal Mined (as of 6/30/08)	68.9 mmt	—	—
Lease Area[2]	5,918.0 ac	1,151.3 ac	1,232.2 ac
Total Area To Be Disturbed[2]	8,354.9 ac	1,925.4 ac	2,210.1 ac
Permit Area[2]	9,722.7 ac	3,162 ac	3,162 ac
Current Air Quality Permitted Production	25.0 mmt	0 mmt	0 mmt
Average Annual Post-2007 Coal Production	13.4 mmt	0 mmt	0 mmt
Remaining Life of Mine (post-2007)	16.2 yrs	4.3 yr	4.3 yr
Average Number of Employees	150	10	10
Total Projected State Revenues (post-2007)[3]	$353.2 million	$102.1 – $123.3 million	$102.1 - $123.3 million
Total Projected Federal Revenues (post-2007)[4]	$261.6 million	$78.1 - $99.3 million	$78.1 - $99.3 million

1 Assumes 90 percent recovery of mineable coal.

2 The lease area includes federal coal leases only and does not include state and private coal within the permit boundary. The disturbed area exceeds the leased area (total federal, state and private) because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

3 Revenues to the state of Wyoming include severance taxes, property and production (Ad Valorum) taxes, sales and use taxes, and Wyoming's share of federal royalty payments, AML fees, and bonus bids. State revenues are based on $0.4312 per ton estimate for severance taxes × amount of recoverable coal, plus $0.372 per ton estimate for Ad Valorum taxes × amount of recoverable coal, plus $0.0569 per ton estimate for sales and use taxes × amount of recoverable coal, plus $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus federal's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus federal's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus federal's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to states.

4 Federal revenues include black lung taxes and the federal government's share of federal royalty payments, AML fees, and bonus bids. Federal revenues are based on $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × black lung tax of 4.40 percent, plus $9.98 per ton (for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus state's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus state's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus state's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to the federal government.

Table 2-5. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for Caballo West LBA Tract and Caballo Mine if the Bishop Road (Campbell County Road 12) is Moved and the Underlying Coal is Recovered.

Item	No Action Alternative (Existing Caballo Mine)	Added by Proposed Action	Added by Alternative 2 (Preferred Alternative)
In-Place Coal (as of 6/30/08)	893.7 mmt	98.2 mmt	131.4 mmt
Mineable Coal (as of 6/30/08)	687.8 mmt	87.5 mmt	105.5 mmt
Recoverable Coal (as of 6/30/08)[1]	584.8 mmt	81.8 mmt	98.6 mmt
Coal Mined (as of 6/30/08)	510.4 mmt	—	—
Lease Area[2]	11,704.5 ac	777.5 ac	1,024.0 ac
Total Area To Be Disturbed[2]	16,898.0 ac	1,349.9 ac	1,390.4 ac
Permit Area[2]	19,974.7 ac	1,294.1 ac	1,518.4 ac
Current Air Quality Permitted Production	50.0 mmt	0 mmt	0 mmt
Average Annual Post-2007 Coal Production	37.8 mmt	0 mmt	0 mmt
Remaining Life of Mine (post-2007)	15.4 yrs	2.2 yr	2.6 yr
Average Number of Employees	549	0	0
Total Projected State Revenues (post-2007)[3]	$949.6 million	$146.0 – $175.3 million	$175.9 - $211.3 million
Total Projected Federal Revenues (post-2007)[4]	$703.4 million	$111.5 - $140.8 million	$134.4 - $169.8 million

1 Assumes 93.5 percent recovery of mineable coal.

2 The lease area includes federal coal leases only and does not include state and private coal within the permit boundary. The disturbed area exceeds the leased area (total federal, state and private) because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

3 Revenues to the state of Wyoming include severance taxes, property and production (Ad Valorum) taxes, sales and use taxes, and Wyoming's share of federal royalty payments, AML fees, and bonus bids. State revenues are based on $0.4312 per ton estimate for severance taxes × amount of recoverable coal, plus $0.372 per ton estimate for Ad Valorum taxes × amount of recoverable coal, plus $0.0569 per ton estimate for sales and use taxes × amount of recoverable coal, plus $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus federal's 50 percent share, plus $0.28per ton for AML fees × amount of recoverable coal minus federal's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus federal's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to states.

4 Federal revenues include black lung taxes and the federal government's share of federal royalty payments, AML fees, and bonus bids. Federal revenues are based on $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × black lung tax of 4.40 percent, plus $9.98 per ton (for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus state's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus state's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus state's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to the federal government.

Table 2-6. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for Caballo West LBA Tract and Caballo Mine if the Bishop Road (Campbell County Road 12) is Not Moved and the Underlying Coal is Not Recovered.

Item	No Action Alternative (Existing Caballo Mine)	Added by Proposed Action	Added by Alternative 2 (Preferred Alternative)
In-Place Coal (as of 6/30/08)	893.7 mmt	98.2 mmt	131.4 mmt
Mineable Coal (as of 6/30/08)	687.8 mmt	87.5 mmt	98.1 mmt
Recoverable Coal (as of 6/30/08)[1]	584.8 mmt	81.8 mmt	91.7 mmt
Coal Mined (as of 6/30/08)	510.4 mmt	—	—
Lease Area[2]	11,704.5 ac	777.5 ac	1,024.0 ac
Total Area To Be Disturbed[2]	16,898.0 ac	1,213.0 ac	1,253.6 ac
Permit Area[2]	19,974.7 ac	1,294.1 ac	1,518.4 ac
Current Air Quality Permitted Production	50.0 mmt	0 mmt	0 mmt
Average Annual Post-2007 Coal Production	37.8 mmt	0 mmt	0 mmt
Remaining Life of Mine (post-2007)	15.4 yrs	2.2 yr	2.4 yr
Average Number of Employees	549	0	0
Total Projected State Revenues (post-2007)[3]	$949.6 million	$146.0 – $175.3 million	$163.6 - $196.5 million
Total Projected Federal Revenues (post-2007)[4]	$703.4 million	$111.5 - $140.8 million	$125.0 - $157.9 million

1 Assumes 93.5 percent recovery of mineable coal. This table excludes all coal beneath the Bishop County Road ROW.

2 The lease area includes federal coal leases only and does not include state and private coal within the permit boundary. The disturbed area exceeds the leased area (total federal, state and private) because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

3 Revenues to the state of Wyoming include severance taxes, property and production (Ad Valorum) taxes, sales and use taxes, and Wyoming's share of federal royalty payments, AML fees, and bonus bids. State revenues are based on $0.4312 per ton estimate for severance taxes × amount of recoverable coal, plus $0.372 per ton estimate for Ad Valorum taxes × amount of recoverable coal, plus $0.0569 per ton estimate for sales and use taxes × amount of recoverable coal, plus $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus federal's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus federal's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus federal's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to states.

4 Federal revenues include black lung taxes and the federal government's share of federal royalty payments, AML fees, and bonus bids. Federal revenues are based on $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × black lung tax of 4.40 percent, plus $9.98 per ton (for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus state's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus state's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus state's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to the federal government.

Table 2-7. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for Maysdorf II LBA Tract, Assuming Wyoming 59 and the BNSF & UP Railroad are Not Moved and the Underlying Coal is Not Recovered and if the Haight and Hilight Roads are Moved and the Underlying Coal is Recovered.

Item	No Action Alternative (Existing Cordero Rojo Mine)	Added by Proposed Action	Added by Alternative 2	Added by Alternative 3 (Preferred Alternative)	
				(North Tract)	(South Tract)
In-Place Coal (as of 6/30/08)	572.9 mmt	504.2 mmt	533.2 mmt	326.4 mmt	206.8 mmt
Mineable Coal (as of 6/30/08)	571.5 mmt	499.7 mmt	527.5 mmt	322.5 mmt	205.0 mmt
Recoverable Coal (as of 6/30/08)[1]	525.9 mmt	449.8 mmt	474.7 mmt	290.2 mmt	184.5 mmt
Coal Mined (as of 6/30/08)	769.3 mmt	—	—	—	—
Lease Area[2]	10,629.1 ac	4,653.8 ac	4,895.6 ac	2,825.4 ac	2,070.3 ac
Total Area To Be Disturbed[2]	14,694.0 ac	6,675.0 ac	6,917.3 ac	3,429.6 ac	3,487.7 ac
Permit Area[2]	16,910.6 ac	16,832.4 ac	16,832.4 ac	6,850.3 ac	10,683.4 ac
Current Air Quality Permitted Production	65.0 mmt	0 mmt	0 mmt	0 mmt	0 mmt
Average Annual Post-2007 Coal Production	46.3 mmt	0 mmt	0 mmt	0 mmt	0 mmt
Remaining Life of Mine (post-2007)	11.4 yrs	9.7 yr	10.3 yr	6.3 yr	4.0 yr
Average Number of Employees	510	63	63	8	2
Total Projected State Revenues (post-2007)[3]	$854.0 million	$805.4 – $972.7 million	$850.1 - $1026.9 million	$519.6 - $627.7 million	$330.4 – $399.0 million
Total Projected Federal Revenues (post-2007)[4]	$632.6 million	$616.0 - $783.4 million	$650.2 - $827.0 million	$397.4 - $505.5 million	$252.7 - $321.3 million

1 Assumes 90 percent recovery of mineable coal. This table excludes all coal that would not be mined beneath the Wyoming 59 ROW and BNSF & UP railroad ROW.

2 The lease area includes federal coal leases only and does not include state and private coal within the permit boundary. The disturbed area exceeds the leased area (total federal, state and private) because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

3 Revenues to the state of Wyoming include severance taxes, property and production (Ad Valorum) taxes, sales and use taxes, and Wyoming's share of federal royalty payments, AML fees, and bonus bids. State revenues are based on $0.4312 per ton estimate for severance taxes × amount of recoverable coal, plus $0.0569 per ton estimate for sales and use taxes × amount of recoverable coal, plus $0.372 per ton estimate for Ad Valorum taxes × amount of recoverable coal, plus $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus federal's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus federal's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus federal's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to states.

4 Federal revenues include black lung taxes and the federal government's share of federal royalty payments, AML fees, and bonus bids. Federal revenues are based on $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × black lung tax of 4.40 percent, plus $9.98 per ton (for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus state's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus state's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus state's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to the federal government.

Table 2-8. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for Maysdorf II LBA Tract, Assuming Wyoming 59, the Haight and Hilight Roads, and the BNSF & UP Railroad are Not Moved and the Underlying Coal is Not Recovered.

Item	No Action Alternative (Existing Cordero Rojo Mine)	Added by Proposed Action	Added by Alternative 2	Added by Alternative 3 (Preferred Alternative)	
				(North Tract)	(South Tract)
In-Place Coal (as of 6/30/08)	572.9 mmt	504.2 mmt	533.2 mmt	326.4 mmt	206.8 mmt
Mineable Coal (as of 6/30/08)	571.5 mmt	482.7 mmt	510.5 mmt	322.5 mmt	188.0 mmt
Recoverable Coal (as of 6/30/08)[1]	525.9 mmt	434.5 mmt	459.5 mmt	290.2 mmt	169.3 mmt
Coal Mined (as of 6/30/08)	769.3 mmt	—	—	—	—
Lease Area[2]	10,629.1 ac	4,653.8 ac	4,895.6 ac	2,825.4 ac	2,070.3 ac
Total Area To Be Disturbed[2]	14,694.0 ac	6,200.8 ac	6,422.5 ac	3,353.9 ac	3,068.6 ac
Permit Area[2]	16,910.6 ac	16,832.4 ac	16,832.4 ac	6,850.3 ac	10,683.4 ac
Current Air Quality Permitted Production	65.0 mmt	0 mmt	0 mmt	0 mmt	0 mmt
Average Annual Post-2007 Coal Production	46.3 mmt	0 mmt	0 mmt	0 mmt	0 mmt
Remaining Life of Mine (post-2007)	11.4 yrs	9.4 yr	9.9 yr	6.3 yr	3.7 yr
Average Number of Employees	510	60	63	8	2
Total Projected State Revenues (post-2007)[3]	$854.0 million	$778.0 – $939.7 million	$822.8 - $993.7 million	$519.6 - $627.7 million	$303.2 – $366.1 million
Total Projected Federal Revenues (post-2007)[4]	$632.6 million	$595.1 - $756.7 million	$629.3 - $800.3 million	$397.4 - $505.5 million	$231.9 - $294.8 million

1 Assumes 90 percent recovery of mineable coal. This table excludes all coal that would not be mined beneath the Wyoming 59 ROW, BNSF & UP railroad ROW, and the Haight and Hilight Roads rights-of-way.

2 The lease area includes federal coal leases only and does not include state and private coal within the permit boundary. The disturbed area exceeds the leased area (total federal, state and private) because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

3 Revenues to the state of Wyoming include severance taxes, property and production (Ad Valorum) taxes, sales and use taxes, and Wyoming's share of federal royalty payments, AML fees, and bonus bids. State revenues are based on $0.4312 per ton estimate for severance taxes × amount of recoverable coal, plus $0.372 per ton estimate for Ad Valorum taxes × amount of recoverable coal, plus $0.0569 per ton estimate for sales and use taxes × amount of recoverable coal, plus $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus federal's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus federal's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus federal's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to states.

4 Federal revenues include black lung taxes and the federal government's share of federal royalty payments, AML fees, and bonus bids. Federal revenues are based on $9.98 per ton (projected for 8,400-Btu coal) price × amount of recoverable coal × black lung tax of 4.40 percent, plus $9.98 per ton (for 8,400-Btu coal) price × amount of recoverable coal × federal royalty of 12.5 percent minus state's 50 percent share, plus $0.28 per ton for AML fees × amount of recoverable coal minus state's 50 percent share, plus bonus payment on LBA leased coal of $0.30 to $0.97 per ton (based on the range of bonus payments made for the last 9 LBAs sold in 2004, 2005, 2008, and 2009) × amount of mineable coal minus state's 50 percent share. These figures could change based on the outcome of recent legislation that changed the percent of distribution of mineral royalties to the federal government.

Table 2-9. Summary Comparison of Magnitude[1] and Duration of Direct and Indirect Impacts for the Proposed Action and Alternatives 2 and 3 and the No Action Alternative for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts[2].

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	***MAGNITUDE AND DURATION OF IMPACT***	
RESOURCE NAME	**NO ACTION ALTERNATIVE**	**PROPOSED ACTION and ALTERNATIVES 2 & 3**
TOPOGRAPHY & PHYSIOGRAPHY (Applicable for all four tracts)		
Lower surface elevation	Moderate, permanent on existing mine areas	Same as No Action on expanded mine areas
Permanent topographic moderation, which could result in:		
Microhabitat reduction	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Habitat diversity reduction	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Big game carrying capacity reduction	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Reduction in water runoff and peak flows	Moderate, beneficial, long term on existing mine areas	Same as No Action on expanded mine areas
Increased precipitation infiltration	Moderate, beneficial, long term on existing mine areas	Same as No Action on expanded mine areas
Reduction in erosion	Moderate, beneficial, long term on existing mine areas	Same as No Action on expanded mine areas
Potential enhanced vegetative productivity	Moderate, beneficial, long term on existing mine areas	Same as No Action on expanded mine areas
Potential acceleration of groundwater recharge	Moderate, beneficial, long term on existing mine areas	Same as No Action on expanded mine areas
Diversion of the Belle Fourche River and Caballo Creek during mining	Moderate, beneficial, long term on existing mine areas	Same as No Action on expanded mine areas
GEOLOGY AND MINERALS (Applicable for all four tracts)		
Removal of coal	Moderate, permanent on existing mine areas	Same as No Action on expanded mine areas
Removal and replacement of topsoil and overburden	Moderate, permanent on existing mine areas	Same as No Action on expanded mine areas
Physical characteristic alterations in replaced overburden	Moderate, permanent on existing mine areas	Same as No Action on expanded mine areas
Loss of unrecovered CBNG though venting and/or depletion of hydrostatic pressure	Minor to moderate, permanent on existing mine areas	Same as No Action on expanded mine areas
Loss of access for development of sub-coal oil and gas resources and other minerals	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Destruction of paleontological resources that are not exposed on the surface	Moderate, permanent on the existing mine areas	Same as No Action on expanded mine areas
AIR QUALITY (Applicable for all four tracts)		
<u>Particulate Emissions:</u>		
Elevated concentrations associated with projected average production of 13 to 46 mmtpy in compliance with ambient standard	Moderate, short term for existing approved mining operations	Same as No Action for from 2 to 10 additional years
Potential for public exposure to particulate emissions along Wyo 59 and in occupied dwellings and businesses in area	Minor to moderate, short term for existing approved mining operations	Same as No Action for from 2 to 10 additional years
Potential for human health impacts as a result of exposure to particulate emissions	Minor to moderate, short term for existing approved mining operations	Same as No Action for from 2 to 10 additional years

Table 2-9. Summary Comparison of Magnitude[1] and Duration of Direct and Indirect Impacts for the Proposed Action and Alternatives 2 and 3 and the No Action Alternative for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts[2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	MAGNITUDE AND DURATION OF IMPACT	
RESOURCE NAME	NO ACTION ALTERNATIVE	PROPOSED ACTION and ALTERNATIVES 2 & 3
AIR QUALITY (Continued)		
NO_x Emissions from Machinery:		
Elevated concentrations associated with average production of 13 to 46 mmtpy in compliance with ambient standard	Moderate, short term for existing approved mining operations	Same as No Action for from 2 to 10 additional years
Potential for public exposure to NO_x emissions from machinery along Wyo 59, various county roads, and for occupied dwellings and businesses located in area	Moderate, short term for existing approved mining operations a	Same as No Action for from 2 to 10 additional years
Potential for human health impacts as a result of exposure to NO_x emissions	Moderate, short term for existing approved mining operations	Same as No Action for from 2 to 10 additional years
NO_x Emissions from Blasting in Compliance with Belle Ayr, Coal Creek , Caballo, and Cordero Rojo Mine Permit Blasting Conditions:		
Potential for public exposure	No projected events	Same as No Action for from 2 to 10 additional years
Potential for human health impacts as a result of exposure to NO_x emissions	No projected events	Same as No Action for from 2 to 10 additional years
Visibility:		
Elevated concentrations of fine particulate matter associated with average production of 13 to 46 mmtpy	Moderate, short term for existing approved mining operations	Same as No Action for from 2 to 10 additional years
Acidification of Lakes:		
SO_2 emissions derived from burning Belle Ayr, Caballo, Coal Creek, and Cordero Rojo coal to produce power	Moderate, short term in vicinity of power plants	Same as No Action on expanded mine area for from 2 to 10 additional years
WATER RESOURCES (Applicable for all four tracts)		
Groundwater		
Removal of coal and overburden aquifers	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Replacement of existing coal and overburden with unconsolidated backfill material	Moderate, permanent on existing mine areas	Same as No Action on expanded mine areas
Depressed water levels in overburden and coal aquifers adjacent to mine	Moderate, short to long term on existing mine and surrounding area	Same as No Action on expanded mine and surrounding area
Change in hydraulic properties in backfilled areas	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas
Increase in TDS concentrations in backfilled areas	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Use of subcoal aquifers for water supply	Negligible, short term on existing mine and surrounding area	Same as No Action for from 2 to 10 additional years

Table 2-9. Summary Comparison of Magnitude[1] and Duration of Direct and Indirect Impacts for the Proposed Action and Alternatives 2 and 3 and the No Action Alternative for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts[2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	*MAGNITUDE AND DURATION OF IMPACT*	
RESOURCE NAME	**NO ACTION ALTERNATIVE**	**PROPOSED ACTION and ALTERNATIVES 2 & 3**
WATER RESOURCES (Continued)		
Surface Water		
Diversion and disruption of surface drainage systems, particularly to a portion of the Belle Fourche River	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Reconstruction of surface drainage systems	Permanent on existing mine areas	Same as No Action on expanded mine areas
Increased runoff and erosion rates on disturbed lands due to vegetation removal	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Increased infiltration on reclaimed lands due to topographic moderation	Moderate, beneficial, long term on existing mine areas	Same as No Action on expanded mine areas
Increased runoff on reclaimed lands due to loss of soil structure	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Potential for adverse downstream effects as a result of sediment produced by large storms	Moderate, long term for existing approved mining operations	Same as No Action on expanded mining operations
Water Rights		
Disruption of water supply for water-rights holders with wells completed in the coal or overburden aquifer within the five-foot drawdown area or with surface water rights within the disturbance area	Minor to moderate, long term on existing mine and surrounding area	Same as No Action on expanded mine and surrounding areas
ALLUVIAL VALLEY FLOORS (Applicable for all four tracts)		
While final determinations have not been made by WDEQ/LQD, it is believed that there are no AVFs significant to agriculture on the proposed lease tracts		
Removal and restoration of AVFs determined not to be significant to agriculture	Moderate, short term on existing leases	Same as No Action on expanded mine areas
Disruptions to streamflows supplying downstream AVFs	Negligible, short term on existing leases	Same as No Action on expanded mine areas
WETLANDS (Applicable for all four tracts)		
Removal of jurisdictional wetlands and loss of wetland function until reclamation occurs	Moderate, short term on existing leases; jurisdictional wetlands would be replaced as required under Section 404 of the Clean Water Act	Same as No Action on expanded mine areas
Removal of non-jurisdictional wetlands and loss of wetland function until reclamation occurs	Moderate, short term to long term on existing leases; non-jurisdictional wetlands would be replaced as required by the surface land owner or WDEQ/LQD	Same as No Action on expanded mine areas

Table 2-9. Summary Comparison of Magnitude[1] and Duration of Direct and Indirect Impacts for the Proposed Action and Alternatives 2 and 3 and the No Action Alternative for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts[2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	***MAGNITUDE AND DURATION OF IMPACT***	
RESOURCE NAME	**NO ACTION ALTERNATIVE**	**PROPOSED ACTION and ALTERNATIVES 2 & 3**
SOILS		
(Applicable for all four tracts)		
Changes in physical properties after reclamation:		
Increased near-surface bulk density and decreased soil infiltration rate resulting in increased potential for soil erosion	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
More uniformity in soil type, thickness, and texture	Moderate, beneficial, long term on existing mine areas	Same as No Action on expanded mine areas
Decreased runoff due to topographic modification	Moderate, beneficial, long term on existing mine areas	Same as No Action on expanded mine areas
Changes in biological properties in soils that are stockpiled before reclamation:		
Reduction in organic matter	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Reduction in microorganism population	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Reduction in seeds, bulbs, rhizomes, and live plant parts	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Changes in chemical properties:		
More uniform soil nutrient distribution	Moderate, beneficial, long term on existingmine areas	Same as No Action on expanded mine areas
VEGETATION		
(Applicable for all four tracts)		
During mining:		
Progressive removal of existing vegetation	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Increased erosion	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Wildlife habitat and livestock grazing loss	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
After revegetation:		
Changes in vegetation patterns	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas
Reduction in vegetation diversity	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas
Reduction in shrub density	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Decreased big game habitat carrying capacity	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Decreased habitat for shrub dependent species	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Potential invasion of non-native plant species	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
WILDLIFE		
(Applicable for all four tracts)		
Displacement of all wildlife from active mining areas	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Increased competition on adjacent undisturbed or reclaimed lands, especially big game	Moderate, short term on adjacent areas	Same as No Action on adjacent areas
Restriction of wildlife movement, especially big game	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Increased mortality of small mammals	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas

Table 2-9. Summary Comparison of Magnitude[1] and Duration of Direct and Indirect Impacts for the Proposed Action and Alternatives 2 and 3 and the No Action Alternative for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts[2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	***MAGNITUDE AND DURATION OF IMPACT***	
RESOURCE NAME	**NO ACTION ALTERNATIVE**	**PROPOSED ACTION and ALTERNATIVES 2 & 3**
WILDLIFE (Continued) (Applicable for all four tracts)		
Surface and noise disturbance of active sage-grouse leks	Moderate, short to long term on existing mine areas	Same as No Action on expanded mine areas
Disturbance of sage-grouse nesting and wintering habitat during mining	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Loss of sage-grouse nesting habitat after reclamation	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Alteration of plant and animal communities after reclamation	Negligible, short term on existing mine areas	Same as No Action on expanded mine areas
Abandonment of raptor nests	Negligible, short term on existing mine areas	Same as No Action on expanded mine areas
Loss of foraging habitat for raptors	Negligible, short to long term on existing mine areas	Same as No Action on expanded mine areas
Loss of nesting and foraging habitat for Migratory Birds of Management Concern	Negligible, short to long term on existing mine areas	Same as No Action on expanded mine areas
Reduction in waterfowl resting and feeding habitat	Negligible, short term on existing mine areas	Same as No Action on expanded mine areas
Loss of habitat for aquatic species, amphibians, and reptiles during mining	Negligible, short term on existing mine areas	Same as No Action on expanded mine areas
Road kills by mine-related traffic	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Reduction in habitat carrying capacity and habitat diversity on reclaimed lands	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Potential reduction in microhabitats on reclaimed lands	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Localized avoidance of foraging areas by big game	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
THREATENED, ENDANGERED, PROPOSED, AND CANDIDATE SPECIES		
Belle Ayr North-(See Appendix E)		
Black-footed ferrets	As determined by previous consultation with USFWS for all species	No effect
Blowout Penstemon		No effect
Ute ladies'-tresses		May affect, not likely to adversely affect
West Coal Creek-(See Appendix E)		
Black-footed ferrets	As determined by previous consultation with USFWS for all species	No effect
Blowout Penstemon		No effect
Ute ladies'-tresses		May affect, not likely to adversely affect
Caballo West-(See Appendix E)		
Black-footed ferrets	As determined by previous consultation with USFWS for all species	No effect
Blowout Penstemon		No effect
Ute ladies'-tresses		May affect, not likely to adversely affect
Maysdorf II-(See Appendix E)		
Black-footed ferrets	As determined by previous consultation with USFWS for all species	No effect
Blowout Penstemon		No effect
Ute ladies'-tresses		May affect, not likely to adversely affect

Table 2-9. Summary Comparison of Magnitude[1] and Duration of Direct and Indirect Impacts for the Proposed Action and Alternatives 2 and 3 and the No Action Alternative for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts[2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	***MAGNITUDE AND DURATION OF IMPACT***	
RESOURCE NAME	**NO ACTION ALTERNATIVE**	**PROPOSED ACTION and ALTERNATIVES 2 & 3**
LAND USE AND RECREATION (Applicable for all four tracts)		
Reduction of livestock grazing	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Loss of wildlife habitat	Moderate, long term on existing mine areas	Same as No Action on expanded mine areas
Loss of access for sub-coal oil and gas development	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Removal of oil and gas production facilities	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Loss of access to public land available for recreation and grazing (Maysdorf II Tract only)	Moderate, short term on existing Cordero Rojo mine area	Same as No Action on expanded Cordero Rojo mine area
CULTURAL RESOURCES (Applicable for all four tracts)		
Sites that are not eligible for NRHP	Ineligible sites may be destroyed without further work on expanded mine areas	Same as No Action on expanded mine areas
Sites that are eligible for NRHP	Impacts to sites that are eligible for the NHRP are not permitted; eligible sites would be avoided or mitigated through data recovery prior to mining on expanded mine areas	Same as No Action on expanded mine areas
Sites that are unevaluated for eligibility	Impacts to unevaluated sites are not permitted; unevaluated sites would be evaluated prior to mining on expanded mine areas	Same as No Action on expanded mine areas
NATIVE AMERICAN CONCERNS (Applicable for all four tracts)	No impact identified on existing mine areas	Same as No Action on expanded mine areas
VISUAL RESOURCES (Applicable for all four tracts)		
During mining:		
Alteration of landscape by mining facilities and operations	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Visibility of mining operations from highway?	Moderate, short term on existing mine areas	Same as No Action on expanded mine areas
Following reclamation:		
Smoother sloped terrain	Negligible, long term on existing mine areas	Same as No Action on expanded mine areas
Reduction in sagebrush density	Moderate, short to long term on existing mine areas	Same as No Action on expanded mine areas
NOISE (Applicable for all four tracts)		
Increased noise levels	Moderate to substantial, short term on existing mines, surrounding areas, and occupied dwellings within 2,500 feet of mining activities	Same as No Action on expanded mine areas

Table 2-9. Summary Comparison of Magnitude[1] and Duration of Direct and Indirect Impacts for the Proposed Action and Alternatives 2 and 3 and the No Action Alternative for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts[2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	***MAGNITUDE AND DURATION OF IMPACT***	
RESOURCE NAME	**NO ACTION ALTERNATIVE**	**PROPOSED ACTION and ALTERNATIVES 2 & 3**
TRANSPORTATION FACILITIES (Applicable for all four tracts)		
Use of railroads and existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mine rail infrastructure to ship coal	Moderate, for duration of existing approved mining operations	Same as No Action for from 2 to 10 additional years
Employee and service contractor use of highways to and from mine sites	Moderate, for duration of existing approved mining operations	Same as No Action for from 2 to 10 additional years
Relocation of pipelines	Negligible, short to long term on existing mine areas	Same as No Action on expanded mine areas
Relocation of utility lines	Negligible, short to long term on existing mine areas	Same as No Action on expanded mine areas
Relocation of county roads to recover coal under lease	Moderate, long term to permanent on existing mine areas	Same as No Action on expanded mine areas
HAZARDOUS AND SOLID WASTE (Applicable for all four tracts)		
Waste generated by mining operations	Negligible for duration of existing approved mining operations	Same as No Action for from 2 to 10 additional years
SOCIOECONOMICS (Applicable for all four tracts)		
Employment	Moderate, beneficial short term for existing approved mining operations	Same as No Action for from 2 to 10 additional years
Revenues from royalties and taxes to the state government	Moderate, beneficial short term for existing approved mining operations	Same as No Action for from 2 to 10 additional years
Revenues from royalties and taxes to the federal government	Moderate, beneficial short term for existing approved mining operations	Same as No Action for from 2 to 10 additional years
Revenues from taxes to local economy	Moderate, beneficial short term for existing approved mining operations	Same as No Action for from 2 to 10 additional years
Additional housing and infrastructure needs	No new impact related to existing mine areas	Same as No Action for from 2 to 10 additional years

[1] Refer to chapter 3 for a discussion on magnitude of impacts.
[2] All impacts are assumed adverse unless noted otherwise.

Table 2-10. Summary Comparison of Magnitude and Duration of Cumulative Impacts[1, 2]

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE RESOURCE NAME	MAGNITUDE, TYPE, AND DURATION OF IMPACT NO ACTION ALTERNATIVE	PROPOSED ACTION and ALTERNATIVES 2 & 3
TOPOGRAPHY & PHYSIOGRAPHY		
Alteration of topography following reclamation of coal disturbance areas	Permanent topographic moderation following reclamation	Same as No Action
Alteration of topography to accommodate coal-related, oil and gas, and oil- and gas-related facilities	Long term to permanent limited changes in discrete, scattered areas	Same as No Action
GEOLOGY AND MINERALS		
Recovery of coal resulting in reduction in coal resources and disturbance and replacement of overburden and topsoil	Moderate, long term to permanent	Same as No Action
Surficial disturbance and reclamation on oil and gas well sites and associated facilities	Moderate, long term to permanent	Same as No Action
PALEONTOLOGY		
Coal, coal-related, oil and gas, and oil- and gas-related development disturbance of PFYC Class 5 Wasatch and Class 3 Fort Union Formations	Permanent potential adverse effects to scientifically significant fossils that are present but not visible prior to disturbance	Same as No Action
AIR QUALITY		
Impacts to Montana near-field receptors		
- 24-hour PM_{10}	A maximum modeled impact in one area above NAAQS for the baseline year and both coal production scenarios for 2010	Same as No Action
- All other parameters	Modeled impacts in compliance with NAAQS and Montana AAQS	Same as No Action
Impacts to Wyoming near-field receptors		
- 24-hour PM_{10}	Modeled impact above NAAQS at some receptors for both coal production scenarios for 2010	Same as No Action
- Annual PM_{10}	Maximum modeled impact above NAAQS at one receptor for the upper production scenario for 2010	Same as No Action
- All other parameters	Modeled impacts in compliance with NAAQS and Wyoming AAQS	Same as No Action
Non-regulatory PSD Impacts at Class I and Sensitive Class II Areas		
- Class I Northern Cheyenne Indian Reservation	Modeled impacts above Class I increment levels for 24-hour PM_{10}, annual PM_{10}, 24-hour SO_2, 3-hour SO_2 for baseline year and both coal production scenarios for 2010; above Class I increment for annual NO_2 for upper coal production scenario for 2010	Same as No Action
- Class I Washakie Wilderness Area and Wind Cave National Park and Class II Crow Indian Reservation	Modeled impacts above Class I increment levels for 24-hour PM_{10} for baseline year and both coal production scenarios for 2010	Same as No Action
- All other Class I and Sensitive Class II modeled receptors	Modeled impacts within Class I increment levels for baseline year and both coal production scenarios for 2010	Same as No Action

Table 2-10. Summary Comparison of Magnitude and Duration of Cumulative Impacts[1, 2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	***MAGNITUDE, TYPE, AND DURATION OF IMPACT***	
RESOURCE NAME	**NO ACTION ALTERNATIVE**	**PROPOSED ACTION and ALTERNATIVES 2 & 3**
Visibility Impacts	199 or more days with a change of 1.0 dv or greater at three Class I areas and seven sensitive Class II areas for the baseline year and both coal productions scenarios	Same as No Action
Acid deposition Impacts	All modeled impacts below the depositions threshold values for nitrogen and sulfur compounds	Same as No Action
- Florence Lake	Modeled impact above 10 percent ANC	Same as No Action
- Upper Frozen Lake	Modeled impact above 1 μeq/L	Same as No Action
- All other modeled sensitive lakes	Modeled impact below threshold values	Same as No Action
GROUNDWATER RESOURCES		
Removal of coal aquifer and replacement with backfill material	Moderate, permanent for mining areas	Same as No Action
Lowering of water levels in aquifers around the mines	Moderate, long term in area immediately west of mines	Same as No Action
Water level decline in sub-coal aquifers as a result of all development	No cumulative impacts anticipated	Same as No Action
Change in groundwater quality as a result of all development	No cumulative impacts anticipated	Same as No Action
Overlapping drawdown in the coal aquifer caused by surface mining and CBNG development	Additive, long term in area immediately west of surface coal mines	Same as No Action
SURFACE WATER RESOURCES		
Surface disturbance of intermittent and ephemeral streams and scattered ponds and reservoirs as a result of coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short term	Same as No Action
Discharge of coal mining and CBNG produced waters into intermittent and ephemeral streams	Moderate, short term	Same as No Action
Sediment input into intermittent and ephemeral streams and scattered ponds and reservoirs as a result of coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short term	Same as No Action
ALLUVIAL VALLEY FLOORS		
Coal mining disturbance of AVFs determined to be significant to agriculture	Not permitted by regulation	Same as No Action
Coal mining disturbance of AVFs determined not to be significant to mining	AVFs disturbed by mining must be restored to essential hydrologic function. No cumulative impacts anticipated	Same as No Action
SOILS		
Coal mining, coal-related, oil and gas, and oil- and gas-related disturbance and replacement of soil resources	Moderate, short term and long term impacts through accelerated wind or water erosion, declining soil quality factors through compaction, reduced microbial populations and organic matter, and potential mixing of soil zones	Same as No Action
CBNG water disposal impacts to soil resources	Potential increase in soil alkalinity depending on SAR levels in water and method of water disposal	Same as No Action

Table 2-10. Summary Comparison of Magnitude and Duration of Cumulative Impacts[1, 2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	MAGNITUDE, TYPE, AND DURATION OF IMPACT	
RESOURCE NAME	**NO ACTION ALTERNATIVE**	**PROPOSED ACTION and ALTERNATIVES 2 & 3**
VEGETATION		
Coal mining, coal-related, oil and gas, and oil- and gas-related removal and replacement of native vegetation	Moderate, short to long term impacts due to potential differences in species composition and presence and size of woody species on reclaimed lands	Same as No Action
Coal mining, coal-related, oil and gas, and oil- and gas-related impacts to Special Status Plant Species	Potential incremental loss of alteration of potential of known habitat	Same as No Action
Coal mining, coal related, oil and gas, and oil- and gas-related dispersal of noxious and invasive species	Potential displacement of native species and changes in species composition	Same as No Action
WETLAND AND RIPARIAN VEGETATION		
CBNG-related discharge of produced water	Moderate, short to long term creation of wetlands in areas that previously supported upland vegetation	Same as No Action
WILDLIFE		
Direct and indirect coal mining, coal-related, oil and gas, and oil- and gas-related development impacts to game and non-game species, including direct mortality, habitat fragmentation, animal displacement, noise, and increased human presence	Moderate, short term	Same as No Action
Coal mining, coal-related, oil and gas, and oil- and gas-related disturbance of game and nongame species habitat during project development and operation	Moderate, short term loss of all types of habitat present in disturbed areas	Same as No Action
Coal mining, coal related, oil and gas, and oil- and gas-related habitat changes after reclamation	Moderate, long term change in habitat with potential changes in associated wildlife populations	Same as No Action
FISHERIES		
Alteration or loss of habitat due to coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short to long term	Same as No Action
Changes in water quality as a result of surface disturbance or introduction of contaminants into drainages caused by coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short to long term	Same as No Action
Changes in available habitat as a result of water withdrawals or discharges related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short term	Same as No Action
SPECIAL STATUS SPECIES		
Direct and indirect coal mining, coal-related, oil and gas, and oil- and gas-related development impacts, including direct mortality, breeding area, nest, or burrow abandonment, noise and increased human presence	Moderate, short term	Same as No Action
Coal mining, coal-related, oil and gas, and oil- and gas-related disturbance of habitat during project development and operation	Moderate, short term loss of all types of special status species habitat present in disturbed areas	Same as No Action
Coal mining, coal related, oil and gas, and oil- and gas-related habitat changes after reclamation	Moderate, long term change in habitat with potential changes in associated populations of special status species	Same as No Action

Table 2-10. Summary Comparison of Magnitude and Duration of Cumulative Impacts[1, 2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	MAGNITUDE, TYPE, AND DURATION OF IMPACT	
RESOURCE NAME	**NO ACTION ALTERNATIVE**	**PROPOSED ACTION and ALTERNATIVES 2 & 3**
LAND USE AND RECREATION		
Loss of forage and range improvements and restriction of livestock movement due to coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short term	Same as No Action
Disturbance of developed recreation sites by coal mining, coal-related, oil and gas, and oil- and gas-related development	Negligible, short term	Same as No Action
Reduction or degradation of opportunities for dispersed recreation activities related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short term on existing mine areas	Same as No Action
CULTURAL RESOURCES		
Disturbance of cultural resource sites	Moderate, permanent	Same as No Action
TRANSPORTATION AND UTILITIES		
Movement of segments of existing highways, pipelines, transmission lines, or railroads to accommodate coal mining development	Moderate, long term to permanent, disruptive effects would be minimized	Same as No Action
TRANSPORTATION AND UTILITIES		
Increased vehicular traffic on roads and highways due to coal mining, coal-related, oil and gas, and oil- and gas-related development, and associated impacts including traffic accidents, road wear, air emissions, dust, noise, and vehicle collisions with wildlife and livestock	Moderate, short term	Same as No Action
Construction and operation of additional railroad and pipeline facilities and transmission lines to transport coal, oil and gas, and electricity	Moderate, short to long term	Same as No Action
SOCIOECONOMICS		
Increases in employment related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Significant, short to long term	Same as No Action
Increases in personal income due to employment, increases related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Significant, beneficial, short to long term	Same as No Action
Increase in population due to employment increases related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Significant, short to long term	Same as No Action
Expansion of housing supply due to employment increases related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Significant, short to long term	Same as No Action
Increases in school enrollment due to employment, increases related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short term	Same as No Action

Table 2-10. Summary Comparison of Magnitude and Duration of Cumulative Impacts[1, 2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	MAGNITUDE, TYPE, AND DURATION OF IMPACT	
RESOURCE NAME	**NO ACTION ALTERNATIVE**	**PROPOSED ACTION and ALTERNATIVES 2 & 3**
SOCIOECONOMICS (Continued)		
Need for additional local government facilities and services due to employment increases related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short to long term	Same as No Action
Increased federal, state, and local revenues related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Significant, beneficial, short to long term	Same as No Action

[1] Cumulative impact discussion in this table and in chapter 4 is based on the PRB Coal Review analyses (BLM 2005b-f, 2006b).
[2] All impacts are assumed to be adverse unless noted otherwise.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the existing conditions of the physical, biological, cultural, and socioeconomic resources in the general South Gillette analysis area for all four of the lease by application (LBA[1]) tracts (the affected environment) and analyzes the direct and indirect impacts to those resources that would be associated with mining the tracts (the environmental consequences) if they are leased under the Proposed Action or Alternative 2 or 3 for each tract. The potential environmental consequences of the No Action alternative for each tract (Alternative 1, rejecting the application) with respect to each of the environmental resources are also considered in this analysis.

> Additional information about the affected environment in the general South Gillette analysis area is contained in a separate document entitled *Supplementary Information on the Affected Environment in the General South Gillette Analysis Area for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II Coal Lease Applications EIS*, which is available on request and can be viewed at the BLM offices in Casper and Cheyenne.

In addition, this chapter considers regulatory compliance, mitigation, monitoring, residual impacts, the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and the irreversible and irretrievable commitments of resources that would occur with implementation of the Proposed Action or Alternative 2 or 3 for each tract. As discussed in chapter 2, regulatory compliance and mitigation and monitoring measures that are required by federal and/or state law are considered to be part of the action alternatives for each tract.

Under the Proposed Action for each tract, the tract as applied for would be offered for lease at one sale. As discussed in chapter 2, the Bureau of Land Management (BLM) has identified a study area for each LBA tract that consists of the tract as applied for and adjacent lands that BLM is considering adding to the tract. BLM is evaluating these study areas to identify potential alternate tract configurations to the Proposed Action that would be technically, economically, or environmentally preferable to the Proposed Action. Alternative 2 for each tract evaluates holding one sale for a tract modified by adding some or all of BLM's study area to the tract. One additional alternative (Alternative 3) for the Maysdorf II tract evaluates dividing the tract into two tracts and offering one or both of those tracts for sale. The Proposed Action and Alternative 2 or Alternative 3 for each LBA tract will be referred to collectively as the action alternatives.

If any of the tracts are leased, it is assumed that an area larger than the tract would have to be disturbed in order to recover all of the coal in the tract. The disturbances outside the coal removal area would be from activities like overstripping, highwall backsloping (including catch benches), highwall reduction

[1] Refer to page xxiii for a list of abbreviations and acronyms used in this document.

after mining to match undisturbed topography, and construction of flood control and sediment control structures. For analysis purposes, this disturbance buffer is assumed to extend ¼ mile outside the BLM study area boundary, where future mining disturbance can occur. In this environmental impact statement (EIS), the general analysis area for each tract is defined as the BLM study area (the LBA tract as applied for and the additional area evaluated under Alternative 2) plus the ¼-mile disturbance buffer.

Figure 3-1 shows the general South Gillette analysis area for resource discussions. The analysis area does not have a defined boundary but includes a general area around the combined BLM study areas for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts.

The resources that are addressed in this EIS were identified during the scoping process or interdisciplinary team review as having the potential to be affected.

The elements of the human environment (BLM 2008a) that could potentially be affected by the action alternatives for each tract include air quality, cultural resources, Native American religious concerns, threatened and endangered (T&E) species, migratory birds, hazardous or solid wastes, water quality, wetlands/riparian zones, floodplains, invasive non-native species, and environmental justice. Four other elements (areas of critical environmental concern, prime or unique farmlands, wild and scenic rivers, and wilderness) are not present in the analysis area and are not addressed further. In addition to the elements that are potentially present in the general South Gillette analysis area, this EIS discusses the status and potential effects of mining each LBA tract on topography and physiography, geology and mineral resources, soils, water quantity, alluvial valley floors, vegetation, wildlife, land use and recreation, paleontological resources, visual resources, noise, transportation resources, climate change, and socioeconomics.

Tables 3-1 through 3-4 shows the total leased and total disturbance areas for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines (No Action alternative), and how the leased areas and estimated disturbance areas would change under the action alternatives.

As indicated in table 3-1, Belle Ayr's current federal, state, and private coal leases include approximately 6,345 acres. Under the currently approved mining and reclamation plan, the mine would disturb a total of approximately 11,621 acres in order to recover that coal. According to Belle Ayr Mine's 2007 Annual Report submitted to Wyoming Department of Environmental Quality (WDEQ)/Land Quality Division (LQD), the mine had disturbed a total of about 5,477 acres as of January 7, 2007 (FCW 2007). Of that area of disturbance, approximately 2,174 acres were occupied by permanent or temporary facilities (stockpiles, hydrologic control structures, mine buildings and coal loading facilities, railroad loop, environmental monitoring areas, etc.), 1,006 acres were being actively mined, and

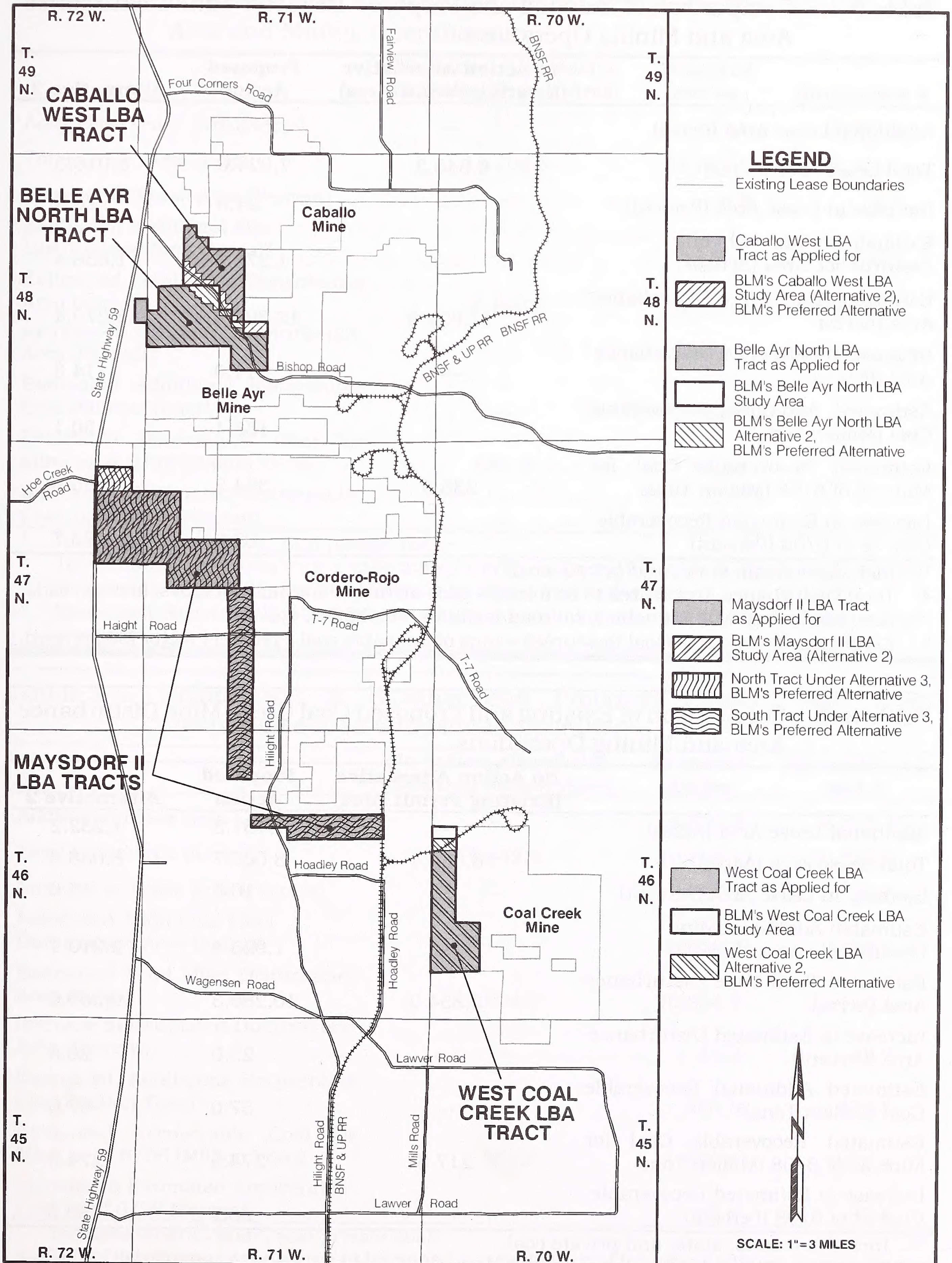


Figure 3-1. General South Gillette Analysis Area.

Table 3-1. Comparison of Existing and Proposed Belle Ayr Mine Disturbance Area and Mining Operations.

	No Action Alternative (Existing Permit Area)	Proposed Action	Alternative 2
Additional Lease Area (Acres)	---	1,578.7	1,671.0
Total Lease Area (Acres)[1]	6,345.3	7,924.0	8,016.3
Increase in Lease Area (Percent)	---	24.9	26.3
Estimated Additional Mine Disturbance Area (Acres)[2]	---	1,274.9	1,658.4
Estimated Total Mine Disturbance Area (Acres)	11,621.0	12,895.9	13,279.4
Increase in Estimated Disturbance Area (Percent)	---	11.0	14.3
Estimated Additional Recoverable Coal (Million Tons)[3]	---	158.4	150.1
Estimated Recoverable Coal for Mine as of 6/08 (Million Tons)	235.8	394.2	385.9
Increase in Estimated Recoverable Coal as of 6/08 (Percent)	---	67.2	63.7

1 Includes federal, state, and private coal.
2 Total Disturbance Area = area to be mined + area disturbed for mine facilities, access roads, haul roads, highwall reduction, railroad facilities, stockpiles, etc.
3 Estimated Recoverable Coal Resources = tons of mineable coal × recovery factor (94 percent).

Table 3-2. Comparison of Existing and Proposed Coal Creek Mine Disturbance Area and Mining Operations.

	No Action Alternative (Existing Permit Area)	Proposed Action	Alternative 2
Additional Lease Area (Acres)	---	1,151.3	1,232.2
Total Lease Area (Acres)[1]	6,854.4	8,005.7	8,086.6
Increase in Lease Area (Percent)	---	16.8	18.0
Estimated Additional Mine Disturbance Area (Acres)[2]	---	1,925.4	2,210.1
Estimated Total Mine Disturbance Area (Acres)	8,354.9	10,280.3	10,565.0
Increase in Estimated Disturbance Area (Percent)	---	23.0	26.5
Estimated Additional Recoverable Coal (Million Tons)[3]	---	57.0	57.0
Estimated Recoverable Coal for Mine as of 6/08 (Million Tons)	217.5	274.5	274.5
Increase in Estimated Recoverable Coal as of 6/08 (Percent)	---	26.2	26.2

1 Includes federal, state, and private coal.
2 Total Disturbance Area = area to be mined + area disturbed for mine facilities, access roads, haul roads, highwall reduction, railroad facilities, stockpiles, etc.
3 Estimated Recoverable Coal Resources = tons of mineable coal × recovery factor (90 percent).

Table 3-3. Comparison of Existing and Proposed Caballo Mine Disturbance Area and Mining Operations.

	No Action Alternative (Existing Permit Area)	Proposed Action	Alternative 2
Additional Lease Area (Acres)	---	777.5	1,024.0
Total Lease Area (Acres)[1]	11,704.5	12,482.0	12,728.5
Increase in Lease Area (Percent)	---	6.6	8.7
Estimated Additional Mine Disturbance Area (Acres)[2]	---	1,213.0	1,253.6
Estimated Total Mine Disturbance Area (Acres)	16,898.0	18,111.0	18,151.6
Increase in Estimated Disturbance Area (Percent)	---	7.2	7.4
Estimated Additional Recoverable Coal (Million Tons)[3]	---	81.8	91.7
Estimated Recoverable Coal for Mine as of 6/08 (Million Tons)	584.8	666.6	676.5
Increase in Estimated Recoverable Coal as of 6/08 (Percent)	---	14.0	15.7

1 Includes federal, state, and private coal.
2 Total Disturbance Area = area to be mined + area disturbed for mine facilities, access roads, haul roads, highwall reduction, railroad facilities, stockpiles, etc.
3 Estimated Recoverable Coal Resources = tons of mineable coal × recovery factor (93.5 percent).

Table 3-4. Comparison of Existing and Proposed Cordero Rojo Mine Disturbance Area and Mining Operations.

	No Action Alternative (Existing Permit Area)	Proposed Action	Alternatives 2 and 3
Additional Lease Area (Acres)	---	4,653.8	4,895.6
Total Lease Area (Acres)[1]	14,442.4	19,096.2	19,338.0
Increase in Lease Area (Percent)	---	32.2	33.9
Estimated Additional Mine Disturbance Area (Acres)[2]	---	6,200.8	6,422.5
Estimated Total Mine Disturbance Area (Acres)	14,694.0	20,894.8	21,116.5
Increase in Estimated Disturbance Area (Percent)	---	42.2	43.7
Estimated Additional Recoverable Coal (Million Tons)[3]	---	434.5	459.5
Estimated Recoverable Coal for Mine as of 6/08 (Million Tons)	525.9	960.4	985.4
Increase in Estimated Recoverable Coal as of 6/08 (Percent)	---	82.6	87.4

1 Includes federal, state, and private coal.
2 Total Disturbance Area = area to be mined + area disturbed for mine facilities, access roads, haul roads, highwall reduction, railroad facilities, stockpiles, etc.
3 Estimated Recoverable Coal Resources = tons of mineable coal × recovery factor (90 percent).

2,297 acres had been mined and reclaimed or were in the process of being reclaimed (FCW 2007).

Coal Creek's current federal, state, and private coal leases include approximately 6,854 acres. Under the currently approved mining and reclamation plan, the mine would disturb a total of approximately 8,355 acres in order to recover that coal (table 3-2). According to Coal Creek Mine's 2006-2007 Annual Report submitted to WDEQ/LQD, the mine had disturbed a total of about 1,975 acres as of December 31, 2006 (TBCC 2007). Of that area of disturbance, approximately 874 acres were occupied by permanent or temporary facilities (stockpiles, hydrologic control structures, mine buildings and coal loading facilities, railroad loop, environmental monitoring areas, etc.), 530 acres were being actively mined, and 571 acres had been mined and reclaimed or were in the process of being reclaimed (TBCC 2007).

As indicated in table 3-3, Caballo's current federal, state, and private coal leases include approximately 11,705 acres and, under the currently approved mining and reclamation plan, the mine would disturb a total of approximately 16,898 acres in order to recover that coal. According to Caballo Mine's 2006 Annual Report submitted to WDEQ/LQD, the mine had disturbed a total of about 6,571 acres as of October 7, 2006 (CCC 2006). Of that area of disturbance, approximately 1,544 acres were occupied by permanent or temporary facilities 1,338 acres were being actively mined, and 3,689 acres had been mined and reclaimed or were in the process of being reclaimed (CCC 2006).

Cordero Rojo's current federal, state, and private coal leases include approximately 14,442 acres. Under the currently approved mining and reclamation plan, the mine would disturb a total of approximately 14,694 acres in order to recover that coal (table 3-4). According to Cordero Rojo's 2006-2007 Annual Report submitted to WDEQ/LQD, the mine had disturbed a total of about 11,354 acres as of June 30, 2007 (CMC 2007a). Of that area of disturbance, approximately 2,969 acres were occupied by permanent or temporary facilities, 4,615 acres were being actively mined, and 3,770 acres had been mined and reclaimed or were in the process of being reclaimed (CMC 2007a).

If the tracts are leased to the applicants as maintenance tracts under the Proposed Action or other action alternatives, the permit area for the adjacent mine would have to be amended to include the new lease area before it could be disturbed by mining activities. Tables 3-1 through 3-4 also show how the leased areas and disturbance areas would change for the tracts as applied for and action alternatives for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts, respectively. The estimates of recoverable coal, associated disturbance, and mine lives shown in tables 3-1 through 3-4 and elsewhere in this chapter assume that coal currently unsuitable for mining is not mined. If the issues involved in the unsuitability designations are resolved, the estimated tons of recoverable coal, associated disturbance, and mine life would increase for each

tract, as discussed in section 2.4. Portions of the LBA tracts are inside current mine permit areas (figure 1-5). If the tracts are leased, the area that would be added to an existing mine permit area would be that portion of the LBA tract that lies outside the existing permit boundary plus an adjacent strip of land that would be used for highwall reduction after mining and other mine-related activities. Some portions of the tracts have been disturbed by the current mining operations in order to recover the coal in the existing coal leases (figure 3-1). The environmental consequences of leasing the LBA tracts under the Proposed Action or Alternative 2 or 3 would be similar in nature, but selection of a Proposed Action would disturb a slightly smaller area of land surface.

Surface mining and reclamation have been ongoing in the eastern PRB for about 3 decades. During this time, effective mining and reclamation technologies have been developed and continue to be refined. Mining and reclamation operations are regulated under SMCRA and Wyoming statutes. WDEQ technically reviews all mine permit application packages to ensure that the mining and reclamation plans comply with all state permitting requirements and that the proposed coal mining operations comply with the performance standards of the DOI-approved Wyoming program. BLM attaches special stipulations to all coal leases (appendix D), and there are a number of federal and state permit approvals that are required in order to conduct surface mining operations (appendix A). The regulations are designed to ensure that surface coal mining impacts are mitigated.

Impacts can range from beneficial to adverse and they can be a primary result of an action (direct) or a secondary result (indirect). They can be permanent, long-term (persisting beyond the end of mine life and reclamation), or short-term (persisting during mining and reclamation and until the time the reclamation bond is released). Impacts also vary in terms of significance. The basis for conclusions regarding significance are the criteria set forth by the Council on Environmental Quality (40 CFR 1508.27) and the professional judgment of the specialists doing the analyses. Impact significance may range from negligible to substantial; impacts can be significant during mining but be reduced to insignificant following completion of reclamation.

3.1 General Setting

The general South Gillette analysis area is located in the PRB, a part of the Northern Great Plains that includes most of northeastern Wyoming. Vegetation is primarily sagebrush and mixed grass prairie.

3.1.1 Climate and Meteorology

The climate in the general South Gillette analysis area is typical of a semi-arid, high plains environment with relatively large seasonal and diurnal variations in temperature and seasonal variation in precipitation. The average annual precipitation at a NOAA meteorological station (Gillette 9ESE), located about 18

miles northwest of the general South Gillette analysis area, is 15.60 inches (WRCC 2007). June (2.69 inches) and May (2.60 inches) are the wettest months, and January (0.57 inch) and February (0.55 inch) are the driest. Snowfall averages 56.5 inches per year, with most occurring in March (10.4 inches) and April (8.5 inches). Potential evapotranspiration, at approximately 31 inches (NOAA 1969), exceeds annual precipitation. Summers are relatively short and warm, while winters are longer and cold. The average daily mean temperature is 45.2 degrees F. The highest recorded temperature was 107 degrees F and the lowest was minus 40 degrees F. July is the warmest month, with a mean daily temperature of 71.0 degrees F, and January is the coldest month, with a mean daily temperature of 21.7 degrees F. The frost-free period is 100-130 days.

In the general South Gillette analysis area, surface wind speeds range from more than 30 mph during the winter and spring to 10 to 12 mph during the summer. The area also experiences extreme wind gusts, especially during thunderstorm activity that occurs in June, July, and August. Distinct diurnal changes occur, with average wind velocities increasing during the day and decreasing during the night. Local variations in wind speed and direction are primarily due to differences in topography. Wind speeds are highest in the winter and spring (October through April) and are predominantly from the western and northern sectors. During the warmer months (May through September), wind directions are more random, although winds from the northern or southeastern sectors are slightly more predominant.

During periods of strong wind, dust may impact air quality across the region. An average of 15 air-stagnation events occurs annually in the PRB with an average duration of 2 days each (BLM 1974).

3.2 Topography and Physiography

3.2.1 Affected Environment

The general South Gillette analysis area is a high plains area within the unglaciated Missouri Plateau subregion of the Great Plains Province, near the eastern portion of the Powder River Basin (PRB) in the state of Wyoming. The PRB is both a topographic drainage and geologic structural basin. The structural basin is an elongated, asymmetrical syncline approximately 120 miles east to west and 200 miles north to south, which is bounded in Wyoming by the Black Hills on the east; the Big Horn Mountains on the west; and the Hartville Uplift, Casper Arch, and Laramie Mountains on the south. The northern extent of the structural basin is the Miles City Arch and the Yellowstone River in Montana. The axis of the structural basin trends from the southeast to the northwest near the western margin of the syncline, and the general South Gillette analysis area is located on the gently dipping eastern limb of the structural basin. In general, geologic strata along the eastern limb of the structural PRB dip to the west at 1 to 2 degrees toward the axis of the basin.

The Powder River Basin is so named because it is drained by the Powder River, although it is also drained in part by other major rivers, including the Big Horn, Tongue, Little Missouri, Belle Fourche, and Cheyenne rivers. The general South Gillette analysis area is within the Cheyenne River drainage basin. Caballo Creek and Belle Fourche River (tributaries of the Cheyenne River) are the most prominent natural topographic features.

Broad plains, rolling hills, and tablelands dominate the PRB landscape. Internally-drained playas are common in the basin, as are buttes and plateaus capped by sandstone or clinker. Elevations throughout the PRB range from less than 2,500 feet to more than 6,000 feet above sea level. The major river valleys have wide, flat floors and broad floodplains. The drainages dissecting the basin are incised, typically are ephemeral or intermittent, and do not provide year-round water sources.

The general South Gillette analysis area is drained by the Caballo Creek and Belle Fourche River. The topography is comprised of intermittent and ephemeral drainage bottomlands, rough breaks, and gently rolling uplands. Unmined lands surrounding the area are characterized by low rolling hills. Surface mine lands, both active and reclaimed, dominate the landscape in the vicinity of the analysis area and east of Wyoming 59. Elevations range from about 4,515 feet to 4,885 feet above sea level and slopes range from flat to around 57 percent. In the individual tracts, the average slopes range from 4 to 5 percent.

Habitat types include sagebrush-grassland, upland-grassland, seeded pastures/cropland, and areas of previous disturbance. Nearly 43 percent of the combined vegetation analysis areas are sagebrush-sagebrush/grassland. Other habitats present in limited extent include bottomland or riparian areas and some open water along the Belle Fourche River and Caballo Creek. Rough breaks and bottomland or riparian areas occur along the ephemeral drainages. Caballo Creek passes from west to east through the north central part of the general South Gillette analysis area and the Belle Fourche River passes through the southern part of the area from southwest to northeast. Overall, the LBA tracts are similar in topography.

3.2.2 Environmental Consequences

3.2.2.1 Proposed Action and Alternatives 2 and 3

Surface coal mining would permanently alter the topography of each LBA tract that is leased and mined. Topsoil would be removed from the land and stockpiled or placed directly on recontoured areas. Overburden would be blasted and stockpiled or directly placed into already mined pits, and coal would be removed. Highwalls with vertical heights equal to overburden/interburden plus coal thickness would exist in the active pits. If necessary, streams would be diverted into temporary channels to prevent pits from being flooded.

Typically, a direct permanent impact of coal mining and reclamation is topographic moderation. After reclamation, the restored land surfaces are generally gentler, with more uniform slopes and restored basic drainage networks. The original topography in Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts range from relatively flat to gently rolling hills. Slopes range from flat to around 57 percent and the average slopes range from 4 to 5 percent. The expected postmining topography would be similar to the premining topography, but somewhat gentler and more uniform. Following reclamation, the average surface elevation on each LBA tract would be lower due to coal removal. Coal removal would be partially offset by the swelling that occurs when the overburden (and interburden, if present) is blasted, removed, and replaced. Table 3-5 presents the approximate postmining surface elevation change for each LBA tract as applied for under the action alternatives. After the coal is removed, the land surface would be restored to approximate original contour or to a configuration approved by WDEQ/LQD when the mining and reclamation permit for the existing mine is amended to include coal removal from the LBA tract.

Direct adverse impacts resulting from topographic moderation include a reduction in microhabitats (e.g., cutbank slopes) for some wildlife species and a reduction in habitat diversity, particularly in slope-dependent shrub communities and associated habitat. These impacts, which would be greater in those areas characterized as rough breaks, may result in a long-term reduction in the carrying capacity for some species. A direct beneficial impact of the lower and flatter terrain would be reduced water runoff, which would allow increased infiltration and a minor reduction in peak flows. This may help counteract the potential for increased erosion that could occur because of higher near-surface bulk density of the reclaimed soils (section 3.8.2.1). It may also increase vegetative productivity and potentially accelerate recharge of groundwater.

The approximate original drainage pattern for each LBA tract, including the diverted portions of Caballo Creek and the Belle Fourche River, would be restored. Stockponds and playas would be replaced to provide livestock and wildlife watering sources. These topographic changes would not conflict with regional land use, and the postmining topography would be designed to adequately support anticipated land use.

These impacts are occurring on the existing Caballo, Belle Ayr, Cordero Rojo, and Coal Creek Mine coal leases as coal is mined and mined-out areas are reclaimed. Under the Proposed Action or Alternative 2 or 3, the areas that would be permanently topographically changed would increase as shown in tables 3-1 through 3-4.

3.2.2.2 No Action Alternative

Under the No Action alternatives, the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications would be rejected and coal removal

Table 3-5. Average Overburden, Interburden, and Coal Thicknesses and Approximate Postmining Surface Elevation Changes of the Four LBA Tracts.

LBA Tract and Configuration	Overburden Thickness (ft)	Interburden Thickness (ft)	Coal Thickness (ft)	Swell Factor (percent)	Coal Recovery Factor (percent)	Postmining Elevation Change[1]
Belle Ayr North						
Proposed Action	295	--	72	13	94	29 ft lower
Alternative 2	295	--	72	13	94	29 ft lower
Existing Belle Ayr Mine Leases						
No Action Alternative for Belle Ayr North Tract	213	--	75	13	94	43 ft lower
West Coal Creek						
Proposed Action	81	1-6	36	19	88	16 ft lower
Alternative 2	81	1-6	36	19	88	16 ft lower
Existing Coal Creek Mine Leases						
No Action Alternative for West Coal Creek Tract	84	1-6	36	19	88	15 ft lower
Caballo West						
Proposed Action	270	--	74	19	94	18 ft lower
Alternative 2	286	--	74	19	94	15 ft lower
Existing Caballo Mine Leases						
No Action Alternative for Caballo West Tract	161	34	66	19	94	25 ft lower
Maysdorf II						
Proposed Action	303	0.3	63	16	93	10 ft lower
Alternative 2	303	0.3	62	16	93	9 ft lower
Alternative 3 North	322	--	65	16	93	9 ft lower
Alternative 3 South	207	2	50	16	93	13 ft lower
Existing Cordero Rojo Mine Leases						
No Action Alternative for Maysdorf II Tract	215	0.6	62	16	93	23 ft lower

[1] Reclaimed (postmining) surface elevation change calculated as: ((overburden thickness + interburden thickness) × swell factor) – (coal thickness × coal recovery factor).

would not occur on the LBA tracts. Mining operations and the associated impacts to topography and physiography would continue as permitted on the existing Caballo, Belle Ayr, Cordero Rojo, and Coal Creek Mine leases. Table 3-5 present the approximate postmining surface elevation change for the existing Caballo, Belle Ayr, Cordero Rojo, and Coal Creek mines. Portions of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts that are contiguous to operating mines would be disturbed to recover the coal in the existing leases.

As discussed in chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II lease applications would not preclude an application to lease the tracts in the future.

3.2.3 Regulatory Compliance, Mitigation and Monitoring

The mined-out areas must be restored to approximate original contour or other topographic configuration approved by WDEQ/LQD. Topographic configurations would be developed and approved as part of the required mining and reclamation plans for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines. WDEQ/LQD monitors topographic restoration by checking the as-built topography in the annual reports filed by the mines to see if it conforms to the approved topography.

3.2.4 Residual Impacts

Topographic moderation is a permanent consequence of mining. The indirect impacts of topographic moderation on wildlife habitat diversity would be permanent.

3.3 Geology, Mineral Resources, and Paleontology

3.3.1 General Geology and Coal Resources

3.3.1.1 Affected Environment

Stratigraphic units in the general South Gillette analysis area that would be impacted if the tracts under consideration for leasing are mined include, in descending order, recent (Holocene age) alluvial and eolian deposits; the Eocene age Wasatch Formation (the overburden), and the Paleocene age Fort Union Formation (which contains the target coal seams). Figure 3-2 is a chart showing the stratigraphic relationships of the surface and subsurface geologic units in the analysis area. Additional information about these units is included in the "Groundwater" section of this document (section 3.5).

Surficial deposits include alluvial and eolian deposits and weathered Wasatch Formation. Alluvial deposits occupy the Caballo Creek and Belle Fourche River

Geologic Unit		Hydrologic Characteristics
RECENT ALLUVIUM HOLOCENE		Typically fine grained and poorly sorted sands interbedded with silts and clays in ephemeral drainages. Occasional very thin, clean interbedded sand lenses. More laterally extensive, thicker, and coarse-grained along the larger stream courses. Excessive dissolved solids generally make this aquifer unsuitable for domestic and agricultural use and marginal for livestock (Class III) use standards. Low infiltration capacity in ephemeral draws unless covered by sandy eolian blanket. Low to moderate infiltration along Little Rawhide Creek.
CLINKER HOLOCENE TO PLEISTOCENE		Baked and fused bedrock resulting from burning coal seams which ignite on the outcrop from lightning, manmade fires or spontaneous combustion. The reddish clinker (locally called scoria, red dog, etc.) formed by melting and partial fusing of overburden above the burning coal. The baked rock varies greatly in the degree of alteration; some is dense and glassy while some is vesicular and porous. It is commonly used as a road construction material and is an aquifer wherever saturated. Considered to be part of the Wasatch Formation.
WASATCH FORMATION EOCENE		Lenticular fine sands interbedded in predominantly very fine grained siltstone and claystone may yield low to moderate quantities of poor to good quality water. The discontinuous nature and irregular geometry of these sand bodies result in low overall permeabilities and very slow groundwater movement in the overburden on a regional scale. Water quality in the Wasatch Formation generally does not meet Wyoming Class I (drinking water) standards due to the dissolved mineral content. Some wells do, however, produce water of considerably better quality that does meet the Class I standard.
FORT UNION FORMATION PALEOCENE	TONGUE RIVER MEMBER (W, R, S)	The coal serves as a regional groundwater aquifer and exhibits highly variable aquifer properties. Permeability and porosity associated with the coal arise almost entirely from fractures. Coal water typically does not meet Class I or Class II (irrigation) use standards. In most cases, water from coal wells is suitable for livestock use. The coal water is used throughout the region as a source of stock water and occasionally for domestic use. W = Wyodak Coal; R = Roland; S = Smith.
FORT UNION FORMATION PALEOCENE	LEBO MEMBER	The Lebo member, also referred to as the "Lebo Confining Layer" or "Lebo Shale". Has a mean thickness of 711 ft in the PRB and a thickness of about 400 ft in the vicinity of Gillette. The Lebo typically yields small quantities of poor quality groundwater. Where sand content is locally large, caused by channel or deltaic deposits, the Lebo may yield as much as 10 gpm.
FORT UNION FORMATION PALEOCENE	TULLOCK MEMBER	The Tullock member has a mean thickness of 785 ft in the PRB and a mean sand content of 53 percent which indicates that the unit generally functions well as a regional aquifer. Yields of 15 gpm are common but vary locally and may be as much as 40 gpm. Records from the SEO indicate that maximum yields of approximately 300 gpm have been achieved from this aquifer. Water quality in the Tullock Member often meets Class I standards. The extensive sandstone units in the Tullock Member are commonly developed regionally for domestic and industrial uses. The City of Gillette is currently using eight wells completed in this zone to meet part of its municipal water requirements.
UPPER CRETACEOUS	LANCE FM/ HELL CREEK FM	This unit is comprised predominantly of marine shales with only occasional local thin sandstone lenses. Maximum yields are minor and overall the unit is not water bearing. Water obtained from this unit is poor with high concentrations of sodium and sulfate as the predominant ions in solution.
UPPER CRETACEOUS	FOX HILLS SANDSTONE	Marine sandstones and sandy shales. Has a mean thickness of 666 ft and a mean sand content over 50 percent in the PRB. Yields up to 200 gpm are common; however, yields can be significantly less. Water quality is good, with TDS concentrations commonly less than 1,000 mg/L. The City of Gillette is currently using five wells completed in this aquifer to meet municipal water requirements.
UPPER CRETACEOUS	PIERRE SHALE	This unit is comprised predominantly of marine shales with only occasional local thin sandstone lenses. Maximum yields are minor and overall the unit is not water bearing. Water obtained from this unit is poor with high concentrations of sodium and sulfate as the predominant ions in solution.

Stratigraphy from Stratigraphic Nomenclature Committee, Wyoming Geological Association, 1969.

Figure 3-2. Stratigraphic Relationship and Hydrologic Characteristics of Upper Cretaceous, Lower Tertiary, and Recent Geologic Units, PRB, Wyoming.

valleys and the lower portions of tributary draws where they join the stream channels.

The Eocene Wasatch Formation forms most of the overburden in the area. The boundary between the Wasatch Formation and the underlying Paleocene Fort Union Formation is not distinct. From a practical standpoint, the top of the mineable coal zone is considered as the contact between the two formations. Table 3-5 indicates the overburden thicknesses in the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts as applied for and under other action alternatives. As discussed previously, the regional dip in this area is to the west; as a result, the overburden thickness is generally thinner to the east and increases to the west.

The Fort Union Formation consists primarily of siltstones, mudstones, claystones, shales, lenticular sands/sandstones, and coal seams. As shown in figure 3-2, this formation is divided into three members: the Tongue River, the Lebo, and the Tullock, in descending order. The Tongue River Member consists of interbedded siltstone, claystone, silty shale, carbonaceous shale, and coal, with lesser amounts of fine-grained sands and sandstones.

The U.S. Geological Survey (Flores et al. 1999) refers to the thick mineable coals in the Gillette coal field as the Wyodak-Anderson coal zone of the Tongue River Member of the Fort Union Formation. The nomenclature of the mineable coal seams in the Tongue River Member varies from mine operator to mine operator in the eastern PRB and are locally referred to as the Anderson and Canyon, Roland and Smith, Wyodak-Anderson, and Wyodak. There is one mineable coal seam (referred to as the Wyodak or Wyodak-Anderson) in the Belle Ayr North and Caballo West tracts as applied for and under Alternative 2. There are two coal seams (referred to as R1 and R3 seams of the Wyodak-Anderson) in the West Coal Creek LBA tract as applied for and under Alternative 2. There is one coal seam (referred to as Wyodak or Wyodak-Anderson) in the Caballo West LBA tract as applied for and as configured under Alternative 2. Up to five noncoal splits or partings occur within the seam, but they are typically local, discontinuous lenses of carbonaceous clay or shale that are less than 1 foot thick. There is one mineable seam (referred to as the Wyodak or Wyodak-Anderson) in the Maysdorf II LBA tract as applied for and as configured under Alternatives 2 and 3. Up to five noncoal splits or partings occur within the seam, but they are typically local, discontinuous lenses of carbonaceous clay or shale that are less than 1 foot thick. The combined average thicknesses of the mineable coal seams within each LBA tract as applied for and the additional area evaluated under Alternative 2 (and Alternative 3 for the Maysdorf II tract) are shown in table 3-5. The combined average thicknesses of interburden between coal seams, if present, are also given in table 3-5.

As discussed in chapter 2, a "no-coal" zone is present within the Maysdorf II tract. It trends east-west throughout the central portion of sections 4 and 5, T.46N.,

R.71W. It is postulated that an ancient drainage channel (or paleochannel) eroded and removed the coal in this area and replaced it with unconsolidated fine sand, occasional gravel, and silty clays (CMC 2007b).

The Fort Union coal seams are subbituminous and are generally low-sulfur, low-ash coals. Typically, the coal being mined in the PRB has a higher heating value and lower sulfur content south of Gillette than north of Gillette. In the four tracts under consideration for leasing, the heating value of the coal seams is expected to average approximately 8,481 Btu/lb, with an average of about 0.30 percent sulfur, 4.76 percent ash, and 30.07 percent moisture.

3.3.1.2 Environmental Consequences

3.3.1.2.1 Proposed Action and Alternatives 2 and 3

The stratigraphic units from the base of the lowest coal seam mined to the land surface would be subject to permanent change after the coal is removed under the Proposed Action or Alternative 2 or 3. Mining would radically change the subsurface characteristics of these lands. The replaced overburden and interburden (backfill) would be a mixture of the geologically distinct layers of sandstone, siltstone, claystone, and shale that currently exist. As a result, the physical characteristics of the backfill would be different from the physical characteristics of the existing layered overburden stratigraphy.

3.3.1.2.1.1 Belle Ayr North LBA Tract

Mining would remove an average of 295 feet of overburden and 72 feet of coal on about 1,579 acres under the Proposed Action and an average of 295 feet of overburden and 72 feet of coal on about 1,669 acres under Alternative 2. These acreage figures represent the estimated area of actual coal removal under the Proposed Action and Alternative 2. Table 3-5 presents the average overburden and coal thicknesses for the Belle Ayr North LBA tract as applied for and for BLM's preferred alternative.

The replaced overburden and interburden would be a relatively homogeneous (compared to the premining layered overburden and interburden) and partly recompacted mixture averaging about 338 feet thick under the Proposed Action and Alternative 2. Approximately 195.5 million additional tons of coal would be recovered under the Proposed Action, compared to an estimated 207.2 million tons under BLM's preferred alternative (Alternative 2).

3.3.1.2.1.2 West Coal Creek LBA Tract

For the West Coal Creek LBA tract, it is estimated that mining would remove an average of 81 feet of overburden and 36 feet of coal on about 1,151 acres under the Proposed Action. Mining would remove an average of 81 feet of overburden

and 36 feet of coal on about 1,232 acres under BLM's alternative. These acreage figures represent the estimated area of actual coal removal under the Proposed Action and Alternative 2. Table 3-5 presents the average overburden and coal thicknesses for BLM's preferred tract configuration under Alternative 2.

The replaced overburden and interburden would be a relatively homogeneous (compared to the premining layered overburden and interburden) and partly recompacted mixture averaging about 105 feet thick under the Proposed Action and Alternative 2. Approximately 57 million additional tons of coal would be recovered under the Proposed Action and BLM's preferred alternative (Alternative 2).

3.3.1.2.1.3 Caballo West LBA Tract

An estimated 270 feet of overburden and 74 feet of coal on about 778 acres under the Proposed Action would be removed. Under BLM's preferred alternative (Alternative 2), mining would remove an average of 286 feet of overburden and 74 feet of coal on about 1,024 acres. These acreage figures represent the estimated area of actual coal removal under the Proposed Action and Alternative 2. Table 3-5 presents the average overburden and coal thicknesses for the Caballo West LBA tract as applied for and for BLM's preferred alternative.

The replaced overburden and interburden would be a relatively homogeneous (compared to the premining layered overburden and interburden) and partly recompacted mixture averaging about 326 feet thick under the Proposed Action and about 345 feet thick under Alternative 2. Approximately 81.8 million additional tons of coal would be recovered under the Proposed Action, compared to an estimated 91.7 million tons under Alternative 2 (BLM's preferred alternative).

3.3.1.2.1.4 Maysdorf II LBA Tract

As shown in table 3-5, mining would remove an average of 303 feet of overburden and 63 feet of coal on about 4,654 acres under the Proposed Action. Under BLM's preferred alternative (Alternative 3), mining would remove an average of 303 feet of overburden and 62 feet of coal on about 4,895 acres. Under that same alternative, mining would remove an average of 322 feet of overburden and 65 feet of coal on about 2,825 acres and an average of 207 feet of overburden and 50 feet of coal on about 2,070 acres under BLM's tract configuration for the south block. These acreage figures are estimates of actual coal removal under the Proposed Action and Alternatives 2 and 3. Table 3-5 presents the average overburden and coal thicknesses for the Maysdorf II LBA tract as applied for, the average overburden and coal thicknesses for Alternative 2, and for Alternative 3 (BLM's preferred tract configuration).

The replaced overburden and interburden would be a relatively homogeneous (compared to the premining layered overburden and interburden) and partly

recompacted mixture averaging about 356 feet thick under the Proposed Action and under Alternative 2, and about 378 and 244 feet thick over the north and south blocks, respectively, under Alternative 3 (BLM's preferred tract configuration). Approximately 434.5 million additional tons of coal would be recovered under the Proposed Action, compared to an estimated 459.5 million tons under Alternative 2 and Alternative 3 (BLM's preferred tract configuration).

3.3.1.2.2 No Action Alternative

Under the No Action alternative for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II the coal lease applications would be rejected. Coal removal and associated disturbance and impacts would not occur on the LBA tracts. Mining operations and associated impacts would continue as permitted on the existing adjacent mine coal leases. Table 3-5 presents the average overburden and coal thicknesses for the existing Caballo, Belle Ayr, Cordero Rojo, and Coal Creek Mine permit areas. There would be impacts to the overburden on portions of the LBA tracts adjacent to the existing mines as a result of recovery of the remaining coal in the existing leases.

As discussed in chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II lease applications would not preclude an application to lease the tracts in the future.

3.3.1.3 Regulatory Compliance, Mitigation and Monitoring

State and federal regulations require that drilling and sampling programs be conducted on existing leases by all mine operators to identify overburden material that may be unsuitable for reclamation (i.e., material that is not suitable for use in reestablishing vegetation or that may affect groundwater quality due to high concentrations of certain constituents, such as selenium, or adverse pH levels). As part of the mine permitting process, each mine operator develops a management plan to ensure that this unsuitable material is not placed in areas where it may affect groundwater quality or revegetation success. Each mine operator also develops backfill monitoring plans as part of the mine permitting process to evaluate the quality of the replaced overburden. These plans are in place for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines and would be developed for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts if they are leased.

Portions of the Wyodak coal seams that may not be recovered due to quality issues are similar with respect to low sulfur content. Therefore, the potential for acid formation is minimal, and any acid formed would be neutralized by the alkaline overburden. The waste coal from any unmined coal remains in the pit to be mixed with and covered by backfilled overburden and interburden materials. Any unsuitable materials in the backfill would be buried under adequate fill so as to be

below the replaced soil to meet regulatory guidelines for vegetation root zones. Regraded overburden would be sampled to verify suitability as subsoil.

3.3.1.4 Residual Impacts

Geology from the base of the coal to the surface would be subject to significant, permanent change.

3.3.2 Other Mineral Resources

3.3.2.1 Affected Environment

3.3.2.1.1 Conventional Oil and Gas

The following discussion is based on information in the *Task 2 Report for the Powder River Basin Coal Review – Past and Present and Reasonably Foreseeable Development Activities* (BLM 2005a), on a December 2007 review of Wyoming Oil and Gas Conservation Commission (WOGCC) database, and on a 2008 reserve estimate prepared by Allen & Crouch Petroleum Engineers, Inc. (A&C) of conventional oil and gas resources in the general South Gillette analysis area (A&C 2008).

The U.S. Geological Survey's (USGS) estimation of undiscovered oil and non-coal bed natural gas resources in the PRB, as of December 2006, are 639 million barrels of oil, 1.16 trillion cubic feet of natural gas, and 131 million barrels of natural gas liquids as of 2006 (USGS 2006). Depths to conventional gas and oil-bearing strata generally range from 4,000 to 13,500 feet.

The Powder River structural basin is one of the richest petroleum provinces in the Rocky Mountain area. Hydrocarbons occur in reservoirs ranging from Mississippian to early Tertiary, in both structural and stratigraphic traps. As discussed in the PRB Coal Review Task 2 Report, oil was first produced from the PRB in 1887 from the Lower Cretaceous Newcastle Sandstone on the east flank of the basin near Moorcroft, Wyoming. In the 1960s and 1970s, drilling moved into deeper parts of the basin that resulted in the discovery of prolific oil fields in stratigraphic traps in Upper and Lower Cretaceous rocks. The discovery of oil from the Lower Cretaceous Muddy Sandstone on the Montana side of the basin set off a flurry of exploration that resulted in a number of discoveries in Wyoming in the Muddy Sandstone. Portions of the Hilight Field and other smaller fields in the vicinity of the analysis area are produced in the Muddy Sandstone. Drilling continued for deeper targets and resulted in the recovery of oil and gas in deeper reserves in the Hilight Field and other fields in the Permian-Pennsylvanian Minnelusa Formation. Through 2005, there had been a 15-year period of very little conventional oil and gas development activity in the PRB (BLM 2005a).

Several conventional oil and gas fields produce in the vicinity of the general South Gillette analysis area, including the Hilight, Maysdorf, and Breen oil and gas fields. Portions of the Maysdorf II (south tract) and West Coal Creek tracts overlay the Hilight field. The Maysdorf and Breen fields are overlain by portions of the Maysdorf II (north tract) tract (De Bruin 2002).

WOGCC data indicate that the Mowry Shale, Muddy Sandstone, and Minnelusa Formation have produced both oil and conventional gas to date in the general analysis area. Approximately 77 percent of the wells have been completed in the Minnelusa Formation, which produce from discontinuous, marginal marine, eolian sandstone deposits. As a result, Minnelusa Formation reservoirs tend to be small and irregularly distributed. Depths to productive traps range from 5,000 feet to 15,000 feet, with most in the 8,000 to 14,000 feet range. The Upper Minnelusa Sandstone play is well established, and most of the Minnelusa wells in the general South Gillette area were drilled in the early 1980s. Field development generally occurred on a 40-acre well spacing. Conventional oil and/or gas wells have been drilled on all four LBA tracts (WOGCC 2007a).

A total of 223 conventional oil and gas wells have been drilled in a 57-section area within or immediately adjacent to the four LBA tract study areas, including a total of 60 within the four LBA tract study areas. As of December 2007 only two oil wells have been drilled within the LBA tracts since 2000, with the most recent well completed in 2006 (WOGCC 2007a).

According to A&C's 2008 evaluation reserve estimate of conventional oil and gas resources, there are currently 18 wells capable of producing oil or conventional gas located on the four LBA tract study areas. Of the 18 wells, 13 are considered to have recoverable reserves using in-place oil and gas recovery methods. Estimated remaining recoverable reserves from these 13 wells are approximately 273,700 barrels of oil and 12 million cubic feet (mmcf) of gas (A&C 2008).

Higher oil prices experienced through late 2008 have helped prevent the abandonment of low-producing wells and could potentially increase conventional oil and gas exploration in the PRB. Enhanced oil recovery using carbon dioxide (CO_2) flooding could increase conventional oil recovery in the south Gillette analysis area but the infrastructure (e.g., CO_2 pipelines, etc.) is not currently in place (BLM 2005a).

Section 3.11 includes a discussion of the ownership of the oil and gas resources in the four LBA tract study areas. Conventional oil and gas wells located in the individual LBA tracts oil and gas general analysis areas that are capable of production are listed in appendix G.

3.3.2.1.2 Coal Bed Natural Gas

Coal Bed Natural Gas (CBNG) has been commercially produced in the PRB since 1989 when production began at the Rawhide Butte Field northwest of Gillette (De Bruin and Lyman 1999). CBNG development has occurred on lands in the vicinity of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts. The predominant CBNG production to date in this area has occurred from the Wyodak-Anderson coal zone, which are the same coal beds (or equivalent to the coal beds) being mined by the surface coal mines. The Wyodak-Anderson zone appears to be gas-bearing throughout the PRB and the methane in the coal beds has been determined to be biogenic in origin. CBNG is also being produced from other, deeper coal seams locally throughout the PRB.

In order for CBNG to be produced, the hydrostatic pressure in the coal must be reduced to a level that can vary from coal to coal, which allows the gas to desorb from the coal. This is accomplished by removing water from the coal bed. CBNG reservoirs can be affected by any nearby activities, including coal mining, that reduce the hydrostatic pressure in the coal bed.

The Wyoming BLM State Office-Reservoir Management Group (WSO-RMG) has recently prepared a variety of detailed analyses of CBNG resources in the lands near the existing surface coal mines in the Wyoming PRB for coal leasing and other actions. This group completed a report in 2006 that describes the existing/affected environment of the coal mining areas and adjacent lands, with respect to CBNG resources, and documents the observed and inferred resource depletion that has and will continue to occur (WSO-RMG 2006).

WSO-RMG and the USGS have collected coal gas content data from coal cores near the mines and in other areas of the PRB. Measured gas content was minimal in all of the Wyodak-Anderson coal cores collected in 2000 at locations near the surface coal mines, indicating that the coal seams were already substantially depleted of CBNG. Average total gas content from the core desorption analyses was approximately 6.8 standard cubic feet per ton (scf/ton) near the coal mines in 2000, compared with an average measured gas content of 37.6 scf/ton from coal cores taken outside the mining areas. Analyses by WSO-RMG, USGS, CBNG operators, and others have shown that dewatering of the coal beds, by both CBNG production and mine dewatering, reduces the hydrostatic pressure in the coals and allows the CBNG to desorb and escape from the coal. These effects have been ongoing and it is likely that desorption has continued since 2000; as a result, coal gas content and the gas-in-place adjacent to the existing mines would currently be expected to be less than in 2000.

The WOGCC well data from the mining townships generally shows that operator interest in the eastern PRB mining areas peaked prior to 2000 and declined rapidly following 2001. Activity had declined to almost negligible levels during 2005 (WSO-RMG 2006).

CBNG wells were initially drilled on 40-acre spacing in the Wyoming PRB. Production/reservoir analyses submitted to the WOGCC in various public hearings indicated that CBNG wells will produce reserves from areas larger than 40 acres. As a result, the WOGCC established an 80-acre spacing pattern as the default spacing for CBNG wells completed within the Fort Union and Wasatch formations. Most CBNG wells on and near the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts were drilled on a 40-acre pattern, either because the wells were drilled before the spacing was changed to 80 acres or under the authorization of spacing exceptions granted by WOGCC. Certain townships in the PRB are exempt from the 80-acre spacing pattern rule, including Ts.46 through 48N., R.71W. (WOGCC 2005a). Although CBNG has been produced in this area for almost 10 years, there are still undrilled 40-acre spacing units in and around the general South Gillette analysis area and there has been little recent interest in drilling additional wells in this area

CBNG is also being produced locally from other deeper seams in the PRB. Fifteen wells have been completed in the deeper Pawnee coal seam on and west of the Maysdorf II LBA tract. All of these Pawnee wells are either shut-in or are producing water (WOGCC 2007a).

WOGCC records show that as of December 13, 2007, 445 wells had been drilled for CBNG production in 57-section area encompassing or immediately adjacent to the general South Gillette analysis area and 288 were capable of producing (WOGCC 2007a). There are 153 CBNG wells within the four LBA tracts.

The ownership of oil and gas resources (including CBNG) in the tracts is discussed in section 3.11. CBNG wells capable of production on or in sections adjacent to the LBA tracts are listed in appendix G.

3.3.2.1.3 Other Minerals

Bentonite, uranium, and scoria are commercially produced in the PRB in addition to conventional oil and gas and CBNG (WSGS 2004 and 2005).

Layers of bentonite (decomposed volcanic ash) of varying thickness are present throughout the PRB. Some of the thicker layers are mined around the edges of the PRB. Bentonite has a large capacity to absorb water, and because of this characteristic it is used in a number of ways, including drilling mud and cat litter. No mineable bentonite reserves have been identified on the LBA tracts under the action alternatives.

There are substantial uranium resources in Johnson, Campbell, and Converse counties. One active uranium mining operation, the Smith Ranch-Highland in-situ recovery operation, is located in west-central Converse County (WSGS 2008). No known uranium reserves exist within the general South Gillette analysis area.

Scoria, also called clinker or burn has been and is a major source of aggregate for road construction in the area due to the shortage of more competent materials. Scoria consists of sediments that were baked, fused, or melted in place when the underlying coal burned spontaneously. Scoria is present within the general analysis area, predominantly east of the coal limit. Scoria occurs only in limited amounts on the LBA tracts or within the additional areas evaluated under the alternatives. Section 3.5.1.1.2 contains additional information on scoria.

No active mining claims are located on the LBA tracts as applied for or within the additional areas evaluated according to a search of the BLM Land and Mineral Use Records (BLM 2007a).

3.3.2.2 Environmental Consequences

3.3.2.2.1 Proposed Action and Alternatives 2 and 3

Other minerals present on the LBA tracts could not be developed until after coal mining and reclamation are completed.

The oil and gas reservoirs below the Wyodak-Anderson coal beds would not be directly disturbed by coal removal. The existing oil and gas wells on the tracts would have to be plugged and abandoned, and all production equipment would have to be removed before mining operations could begin. Following mining and reclamation, the oil and gas lessees could drill new wells to recover oil and gas resources from any productive subcoal oil and gas reservoirs. This would only occur if they believe that the value of the reserves would justify the expense of drilling the wells and rebuilding the production infrastructure. As discussed above, conventional oil and gas resources in the general South Gillette analysis area have been extensively developed. WOGCC records show that 18 conventional oil and gas wells located on the tracts' study areas are capable of producing. These 18 wells include 16 active wells, one temporarily abandoned well, and one shut-in well. Seven injector wells located on the LBA tract study areas are not capable of producing, but they are important to continued field production. According to A&C's 2008 evaluation, actively producing wells within the LBA tracts have exhausted most of their recoverable reserves, with approximately 8 percent of the recoverable oil and 2 percent of the recoverable gas remaining in these wells. Only two wells have been drilled in this area since 2000, so the area generally appears to be unfavorable for additional production from known reservoirs or new discoveries, given the current economic conditions and drilling technology.

Before mining operations could begin, all active CBNG wells would have to be plugged and abandoned, and all gas production equipment would have to be removed. CBNG resources that have not been recovered from the Wyodak-Anderson zone prior to mining would be lost when the coal is removed.

CBNG production requires withdrawing water from the coal seams to reduce hydrostatic pressure enabling methane desorption from the coals. WSO-RMG's analyses indicate that depletion of the hydrostatic pressures and methane resources starts to occur adjacent to mining areas a short time after mining begins. CBNG depletion had already occurred near the mining areas in the Wyodak-Anderson zone by the time that CBNG development began to accelerate in the late 1990s (WSO-RMG 2006). Groundwater level data compiled by the Gillette Area Groundwater Monitoring Organization (GAGMO) in 2000 and earlier indicated that widespread hydrostatic pressure depletion in the affected coal seam aquifers had occurred since mining began in the late 1970s and early1980s. Hydrostatic pressures had declined by as much as 60 percent in the southern group of mines, and coal gas in place can be inferred to have been depleted by similar proportions. The ongoing reduction of hydrostatic pressure in the coal beds due to mining has been accelerated by extensive CBNG production from surrounding lands.

WSO-RMG's analyses of the production and reservoirs indicate that the CBNG resource within the Wyodak-Anderson seam has been substantially depleted, either by mining or by recovery from producing wells. It seems likely that the wells presently capable of production that are located within the BLM study areas for the four LBA tracts included in this EIS (appendix G) will have exhausted their economic reserves prior to initiation of mining in the LBA tracts. It is also likely that any undrilled spacing units in the BLM study areas will have been drained by production from the existing wells and nearby mining activity before mining begins in the LBA tracts. Mining operations within the LBA tracts could not begin until permitting is completed, which generally requires several years after a lease is acquired. By that time, it is likely that most of the economically recoverable CBNG resource would have been produced. CBNG production from the coal zones underlying the Wyodak-Anderson coal zone would not be directly disturbed by surface mining operations and could be delayed as the parcel is mined. If production from these lower seams is established on the LBA tracts in the future, additional measures would be required to accommodate both mining and CBNG production (section 3.3.2.3).

Section 3.11.1 includes a discussion on the ownership of the oil and gas resources on the LBA tracts and the oil and gas facilities in the area of the tracts.

<u>3.3.2.2.2 No Action Alternative</u>

Under the No Action alternatives, the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications would be rejected and coal removal would not occur. Mining operations would continue to limit the development of other mineral resources described above on the existing adjacent Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mine coal leases. Mineral development limitations related to mining operations at the mines would not be extended onto

portions of the LBA tracts that will not be affected under the current mining and reclamation plan.

As discussed in chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.3.2.3 Regulatory Compliance, Mitigation and Monitoring

The reservoir analyses conducted by the A&C indicate that most of the recoverable conventional oil and gas and CBNG resources on the LBA tracts have been extracted by the existing wells. Reservoir analyses conducted by the BLM WSO-RMG indicate that most of the recoverable CBNG resources in the Wyodak-Anderson coal zone on these tracts have probably been produced by the existing wells. Potential does exist for conflicts between coal operations and CBNG and conventional oil and gas wells completed in formations and coal zones below the Wyodak-Anderson seam.

If the federal coal in the tract is leased and conflicts do develop between the operators of the oil and gas wells and the surface coal mine operator, several mechanisms exist that can be used to facilitate recovery of the conventional oil and gas and CBNG resources prior to mining. These include:

- BLM will attach a multiple mineral development stipulation to the federal coal lease stating that BLM has the authority to withhold approval of coal mining operations that would interfere with the development of mineral leases issued prior to the coal lease (appendix D).
- Conventional oil and gas wells must be plugged and abandoned while mining and reclamation operations are in progress. These wells could be recompleted or redrilled following mining if the value of the remaining reserves would justify the expense of reestablishing production.
- BLM has a policy in place on CBNG-coal conflicts (BLM Instruction Memorandum No. 2006-153), which directs BLM decision-makers to optimize the recovery of both resources and ensure that the public receives a reasonable return (BLM 2006a). This memorandum offers royalty incentives to CBNG operators to accelerate production to recover the natural gas while simultaneously allowing uninterrupted coal mining operations. In addition, this memorandum also states that it is the policy of the BLM to encourage oil and gas and coal companies to resolve conflicts between themselves; when requested, the BLM will assist in facilitating agreements between the companies.
- Mining the LBA tracts cannot occur until the coal lessees have a permit to mine the tract approved by the WDEQ/LQD and a MLA mining plan

approved by the Secretary of the Interior. Before the MLA mining plans can be approved, BLM must approve each R2P2 for mining the tracts. Prior to approving the each R2P2, BLM can review the status of CBNG and conventional oil and gas development on the tract and the mining sequence proposed by the coal lessee. The permit approval process generally takes the coal lessee several years, during which time CBNG resources can be recovered.

- Before mining commences the coal lessee can negotiate an agreement with owners and operators of existing oil and gas facilities (pipelines) on the tract regarding removal and relocation of those facilities.

3.3.2.4 Residual Impacts

CBNG resources that have not been recovered from the Wyodak-Anderson zone prior to mining would be lost when the coal is removed.

3.3.3 Paleontology

3.3.3.1 Affected Environment

The formation exposed on the surface of the tracts is the sedimentary Eocene Wasatch Formation, which is known to produce fossil vertebrates of scientific significance throughout Wyoming, including the PRB (Delson 1971, Winterfeld 1978, EVG 2001).

BLM ranks areas according to their potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. The Wasatch Formation is ranked as fulfilling BLM Paleontology Condition No. 1, which the Paleontological Resource Management Handbook 8270-I describes as "areas that are known to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils." According to the handbook, "consideration of paleontological resources will be necessary if the Field Office review of available information indicates that such fossils are present in the area".

The BLM in Wyoming uses an additional planning tool, called the Possible Fossil Yield Classification (PFYC), to classify geological units, usually at the formation or member level, according to the probability that they will yield paleontological resources that are of concern to land managers. This classification system is based largely on how likely a geologic unit is to produce scientifically significant fossils. BLM considers the Wasatch Formation to fulfill either the PFYC Class 4 or Class 5, depending on the nature of bedrock exposures present. PFYC classes 4 and 5 are described as follows:

Class 4 - These geologic units are Class 5 units (see below) that have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation.

Class 5 - Fossiliferous geologic units that regularly and predictably produce vertebrate fossils and/or scientifically significant non-vertebrate (plant and invertebrate) fossils, and that are at risk of natural degradation and/or human-caused adverse impacts.

Although the Wasatch Formation is known to produce fossil vertebrates of scientific significance in Wyoming, outcrops of the Wasatch Formation in the PRB are generally not well-exposed and the conditions of deposition of the formation have contributed to a low preservation potential for fossils. Vertebrate fossils that have been described from this formation include mammals such as early horses, tapiroids, condylarths, primates, insectivores, marsupials, creodonts, carnivores, and multituberculates; reptiles such as crocodilians, alligators, lizards, and turtles; birds; eggs; amphibians; and fish. Non-marine invertebrates such as mollusks and ostrocods have also been described from the Wasatch.

Fossil plant material is common in the Wasatch Formation, particularly leaves and fossilized wood. The leaves usually occur as lignitic impressions in sandstone and siltstone and as compact masses in shale. Leaves are the most abundant fossils found during paleontological surveys and are frequently encountered during mining operations. Fossilized wood often occurs near the top of a coal seam, in carbonaceous shale or within channel sandstone. Exposures of fossil logs are common, but usually very fragmentary. Like fossil leaves, fossil logs can be readily collected in the PRB.

Paleontological surveys were conducted in conjunction with the Class III cultural resource inventories of the current Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine permit areas and the BLM study areas for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts (the tracts as applied for and the additional area evaluated under other action alternatives). Pedestrian examinations for fossil indications were conducted along rock outcrops. One of the primary goals of the paleontological surveys was to locate unique pockets of fossilized bone such as those reported elsewhere in the Wasatch Formation in the PRB. Such concentrations of fossilized bone were not found, nor were any fossil vertebrates. Several fossil localities occur in exposures of the Wasatch Formation south of the Belle Fourche River in sections 9, 10, and 14, T.46N., R.71W. None of the fossil material found at these localities or at other localities within the general South Gillette analysis area is considered to have much scientific significance; as a result no specimens were collected. Vertebrate fossils appear to be very scarce. Fossilized (a.k.a. petrified or silicified) wood is much more common and observed at many unrecorded locations, particularly associated with coal. Because of the ubiquitous nature of fossilized plants and invertebrates, reporting is typically confined to vertebrate specimens or unique finds.

No significant or unique paleontological resource localities have been recorded on federal lands in the general South Gillette analysis area and no specific mitigation has been recommended for paleontology.

3.3.3.2 Environmental Consequences

3.3.3.2.1 Proposed Action and Alternatives 2 and 3

The rock outcrops present on the tracts were examined for the presence of fossils and no scientifically significant fossils were located. Fossils with scientific significance could be present on the tract but not exposed at the surface. If the tracts are leased under the Proposed Action or Alternatives 2 or 3, buried paleontological resources would be destroyed when the overburden is removed.

3.3.3.2.2 No Action Alternative

Under the No Action alternative, the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications would be rejected and coal removal would not occur. Mining operations would continue at the existing adjacent mines and on portions of the LBA tracts adjacent to the applicant mines, which would destroy potentially significant paleontological resources.

As discussed in chapter 2, a decision to reject the lease applications at this time would not preclude an application to lease the tracts in the future.

3.3.3.3 Regulatory Compliance, Mitigation and Monitoring

If the tracts are leased, BLM will attach a stipulation to each lease requiring the operator to report significant paleontological finds to the authorized federal agency and suspend production in the vicinity of the find until an approved paleontologist can evaluate the paleontological resource (appendix D).

3.3.3.4 Residual Impacts

Paleontological resources that are not identified and removed prior to or during mining operations would be lost.

3.4 Air Quality

There is substantial scientific evidence that increased atmospheric concentrations of greenhouse gases (GHG) and land use changes are contributing to an increase in average global temperature. However since these gases are not regulated pollutants, discussions of this subject are included in sections 3.18.2 and 4.2.14.

The information in this section and in the supplemental air quality Information appendix (appendix H) is based on the air quality information provided by the

Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines and from various state and federal sources. This section summarizes the affected environment in the general South Gillette analysis area and the potential air quality impacts if the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts are leased and mined. Appendix H provides background information on the air quality regulatory framework, regional conditions, dispersion model methodology, the BACT process, etc. Existing and projected cumulative air quality impacts are discussed in section 4.2.3.

3.4.1 Background

The air quality of any region is controlled primarily by the magnitude and distribution of pollutant emissions and the regional climate. The transport of pollutants from specific source areas is strongly affected by local topography. In the mountainous western United States, topography is particularly important in channeling pollutants along valleys, creating upslope and downslope circulations that may entrain airborne pollutants, and blocking the flow of pollutants toward certain areas. In general, local effects are superimposed on the general weather regime and are most important when the large-scale wind flow is weak.

The general South Gillette analysis area, shown in figure 3-1, is located in the east-central portion of the PRB, a part of the Northern Great Plains that includes most of northeastern Wyoming. As discussed in section 3.2.1, the topography is primarily rolling plains and tablelands of moderate relief (with occasional valleys and buttes). Elevations range from about 4,520 ft to 4,885 ft above sea level. The climate in the general South Gillette analysis area is semiarid with relatively short warm summers and longer cold winters. Evaporation exceeds annual precipitation. section 3.1.1 includes additional information about the climate in the general South Gillette analysis area.

Air Quality regulations applicable to surface coal mining may include the National Ambient Air Quality Standards/Wyoming Ambient Air Quality Standards (NAAQS/WAAQS), Prevention of Significant Deterioration (PSD), National Source Performance Standards (NSPS), and the Federal Operating Permit Program (Title V). These regulatory programs are described in appendix H. Air pollution impacts are limited by local, state, tribal, and federal air quality regulations and standards, and state implementation plans, or SIPs, established under the federal CAA and the CAAA of 1990. In Wyoming, air pollution impacts are managed by WDEQ/AQD under the WAQSR and the EPA-approved SIP.

3.4.1.1 Emission Sources

Air quality conditions in rural areas are likely to be very good, as they are characterized by limited air pollution emission sources (few industrial facilities and residential emissions in the relatively small communities and isolated ranches) and good atmospheric dispersion conditions, resulting in relatively low

air pollutant concentrations. However, the potential exists for localized pockets of high concentrations of PM_{10}, sulfur dioxide (SO_2), and nitrogen dioxide (NO_2), due to the large number of minor sources in the area (BLM 2005b). Occasional high concentrations of CO and particulate matter may also occur in more urbanized areas (e.g., cities of Gillette, Sheridan, and Buffalo) and around industrial facilities, especially under stable atmospheric conditions that occur during winter.

Surface coal mining activities generate fugitive dust and particulate and gaseous tailpipe emissions from large mining equipment. Specifically, activities such as blasting, excavating, loading and hauling of overburden and coal, and wind erosion of disturbed and unreclaimed mining areas produce fugitive dust. Coal crushing, storage, and handling facilities are the most common stationary or point sources associated with surface coal mining and preparation. Particulate matter is the pollutant emitted from coal mine point sources, although small amounts of gaseous pollutants are emitted from small boilers and off-road diesel engines. Wyoming's ambient air standards for particulates are shown in table 3-6.

Blasting is also responsible for another type of emission from surface coal mining. Overburden and coal blasting sometimes produces gaseous, orange-colored clouds that contain NO_2. Exposure to NO_2 may have adverse health effects, as discussed in section 3.4.3. NO_2 is one of several products resulting from the incomplete combustion of explosives used in the blasting process. Wyoming's ambient air standards for NO_2 are shown in table 3-6.

Other existing air pollutant emission sources within the region include:

- CO and nitrogen oxides (NO_X) from internal combustion engines used at natural gas and CBNG pipeline compressor stations;
- CO, NO_X, particulates (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), and volatile organic compounds (VOCs) from gasoline and diesel vehicle tailpipe emissions;
- Particulate matter (dust) generated by vehicle travel on unpaved graded roads, agricultural activities such as plowing, and paved road sanding during the winter months, as well as windblown dust from neighboring areas;
- NO_2 and PM_{10} emissions from railroad locomotives used to haul coal;
- SO_2 and NO_X from power plants. The closest coal-fired power plants are the Dave Johnston plant, located about 40-60 miles south-southwest of these six LBA tracts, and the Wyodak, Wygen, and Neil Simpson plants, located about 35-55 miles north of these six LBA tracts;

Table 3-6. Assumed Background Air Pollutant Concentrations, Applicable AAQS, and PSD Increment Values (in μg/m³).

Criteria Pollutant	Averaging Time[1]	Background Concentration	Primary NAAQS[2]	Secondary NAAQS[2]	WAAQS	PSD Class I Increments	PSD Class II Increments
Carbon monoxide	1-hour	3,336[4]	40,000	40,000	40,000	---	---
	8-hour	1,381	10,000	10,000	10,000	---	---
Nitrogen dioxide	Annual	7[5]	100	100	100	2.5	25
Ozone	8-hour	132[6]	147	147	157	---	---
Sulfur dioxide	3-hour	141[7]	---	1,300	1,300	25	512
	24-hour	71[7]	365	---	260	5	91
	Annual	11[7]	80	---	60	2	20
PM_{10}[8]	24-hour	70[9]	150	150	150	8	30
	Annual	16[9]	--	--	50	4	17
$PM_{2.5}$[8]	24-hour	15[10]	35	35	65	---	---
	Annual	6[10]	15	15	15	---	---

1 Annual standards are not to be exceeded; short-term standards are not to be exceeded more than once per year.
2 Primary standards are designed to protect public health; secondary standards are designed to protect public welfare.
3 All NEPA analysis comparisons to the PSD increments are intended to evaluate a threshold of concern and do not represent a regulatory PSD Increment Consumption Analysis.
4 Data collected by Amoco at Ryckman Creek for an eight-month period during 1978-1979, summarized in Riley Ridge EIS (BLM 1983).
5 Data collected at site located 15 SSW of Gillette, Campbell County, Wyoming, 2005-2008.
6 Data collected at Wyodak Site 4, Campbell County, Wyoming, 2005-2008 (8-hour 4th high).
7 Data collected at Wyodak Site 4, Campbell County, Wyoming, 2005-2008.
8 On October 17, 2006, EPA published final revisions to the NAAQS for particulate matter that took effect on December 18, 2006. The revision strengthens the 24-hour $PM_{2.5}$ standard from 65 to 35 μg/m³ and revokes the annual PM_{10} standard of 50 μg/m³. The State of Wyoming will enter into rulemaking to revise the WAAQS.
9 Data collected at the Belle Ayr Mine, Campbell County, Wyoming, 2005-2008.
10 Data collected at the Belle Ayr Mine (Site Ba-4, 5n, 5s), Campbell County, Wyoming, 2005-2008.
Source: (BLM 2005b and WDEQ/AQD)

- Air pollutants transported from emission sources located outside the PRB; and
- Ground level ozone (O_3) is not emitted directly into the air, but is created by chemical reactions between NO_X and VOCs in the presence of sunlight.

3.4.2 Particulate Emissions

3.4.2.1 Affected Environment for Particulate Emissions

The federal standard for particulate matter pollutant was specified as total suspended particulates (TSP) until 1987. This measurement included all particulates generally less than 100 microns in diameter. In 1987, the form of the standard was changed from TSP to PM_{10} to better reflect human health effects. PM_{10} represents particulate matter with a mean aerodynamic diameter of 10 microns or less that can potentially penetrate into the lungs and cause health problems. In 1997, EPA set separate standards for fine particles (particulate matter with a mean aerodynamic diameter of 2.5 microns or less, or $PM_{2.5}$), based on their link to serious health problems. In 2006, EPA revised the air quality standards for particulate matter by tightening the 24-hour fine particle standard from the previous level of 65 micrograms per cubic meter ($\mu g/m^3$) to 35 $\mu g/m^3$ and revoking the annual PM_{10} standard of 50 $\mu g/m^3$. EPA retained the existing annual $PM_{2.5}$ standard of 15 $\mu g/m^3$ and the 24-hour PM_{10} standard of 150 $\mu g/m^3$. These revisions took effect on December 18, 2006. The current federal ambient air standards are shown in 3-6.

While retaining the TSP standard until March 2000, Wyoming added the PM_{10} standard in 1989. Wyoming also adopted a $PM_{2.5}$ standard in March 2000. In view of the December 2006 revisions to the NAAQS for particulate matter, the state of Wyoming will enter into rulemaking to revise the WAAQS for particulate matter so that they remain as stringent as or more stringent than the NAAQS. Even with the evolution of state or federal small size particulate standards, TSP is still monitored in some PRB locations as a surrogate for PM_{10} and as an indication of overall atmospheric levels of particulate matter.

WDEQ/AQD requires monitoring data to document the air quality at all of the PRB mines. According to EPA AirData, in 2007 there were six TSP monitors, five $PM_{2.5}$ monitors and 36 PM_{10} monitors in the Wyoming portion of the PRB. Data for TSP date back to 1980 and data for PM_{10} date back to 1989. Through 2004, approximately 57,000 TSP samples had been collected and approximately 47,550 PM_{10} samples had been collected through 2007. Information about the regulatory framework, the monitoring network, and PM_{10} concentration trends since monitoring began are included in appendix H. Existing site specific air quality information is included in the SGAC EIS Supplementary Information document, which is available on request.

Historical particulate matter ambient air quality data for the general South Gillette analysis area air quality monitoring sites generally show the same results as described above for the PRB as a whole. The locations of PM_{10}, $PM_{2.5}$, and TSP (if monitored) particulate emission monitoring samplers at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines are shown on figures 3-3 through 3-6, respectively. The progression of mining operations requires that the location and number of particulate monitors be adjusted in order to provide the best documentation of the ambient air quality. Figure 3-7 presents the average annual emission measured by general South Gillette analysis area particulate monitors from 1997 through 2007 for PM_{10} emissions. Annual PM_{10} emissions for the SGAC area were calculated by averaging the available annual PM_{10} values (obtained from the EPA AirData website) from air quality monitoring sites for the four SGAC mines. Annual coal and overburden production for the general South Gillette analysis area mines for these years are also shown on figure 3-7.

According to EPA AirData information, no exceedances of the 24-hour or annual PM_{10} particulate standards had been documented by the Belle Ayr, Coal Creek, Caballo, or Cordero Rojo mines through 2007.

The annual $PM_{2.5}$ standard is attained when the 3 year average is less than or equal to 15 µg/m³. Compliance with the 24-hour $PM_{2.5}$ NAAQS is met when the 3-year average of the 98th percentile concentration is less than or equal to 35 µg/m³ (WDEQ/AQD 2008a). According to EPA AirData, all $PM_{2.5}$ monitors in the PRB were in compliance through 2007(EPA 2009a).

3.4.2.2 Environmental Consequences Related to Particulate Emissions

Particulates include solid particles and liquid droplets that can be suspended in air. Particulates, especially fine particles, have been linked to numerous respiratory-related illnesses and can adversely affect individuals with pre-existing heart or lung diseases (EPA 2007a). They are also a major cause of visibility impairment in many parts of the United States. While individual particles cannot be seen with the naked eye, collectively they can appear as black soot, dust clouds, or gray hazes.

3.4.2.2.1 Proposed Action and Alternatives 2 and 3

Potential particulate emissions related to mining operations at the existing mines are described below. Because of the similarities in mining rates and mining operations, the potential impacts of mining the LBA tracts have been inferred from the projected impacts of mining the existing coal leases as currently permitted.

Long-term (annual) PM_{10} modeling was conducted for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines' most recent WDEQ/AQD air quality permit applications to demonstrate compliance with the annual WAAQS for PM_{10}. All four mines utilized the Industrial Source Complex Model, Long Term Version 3

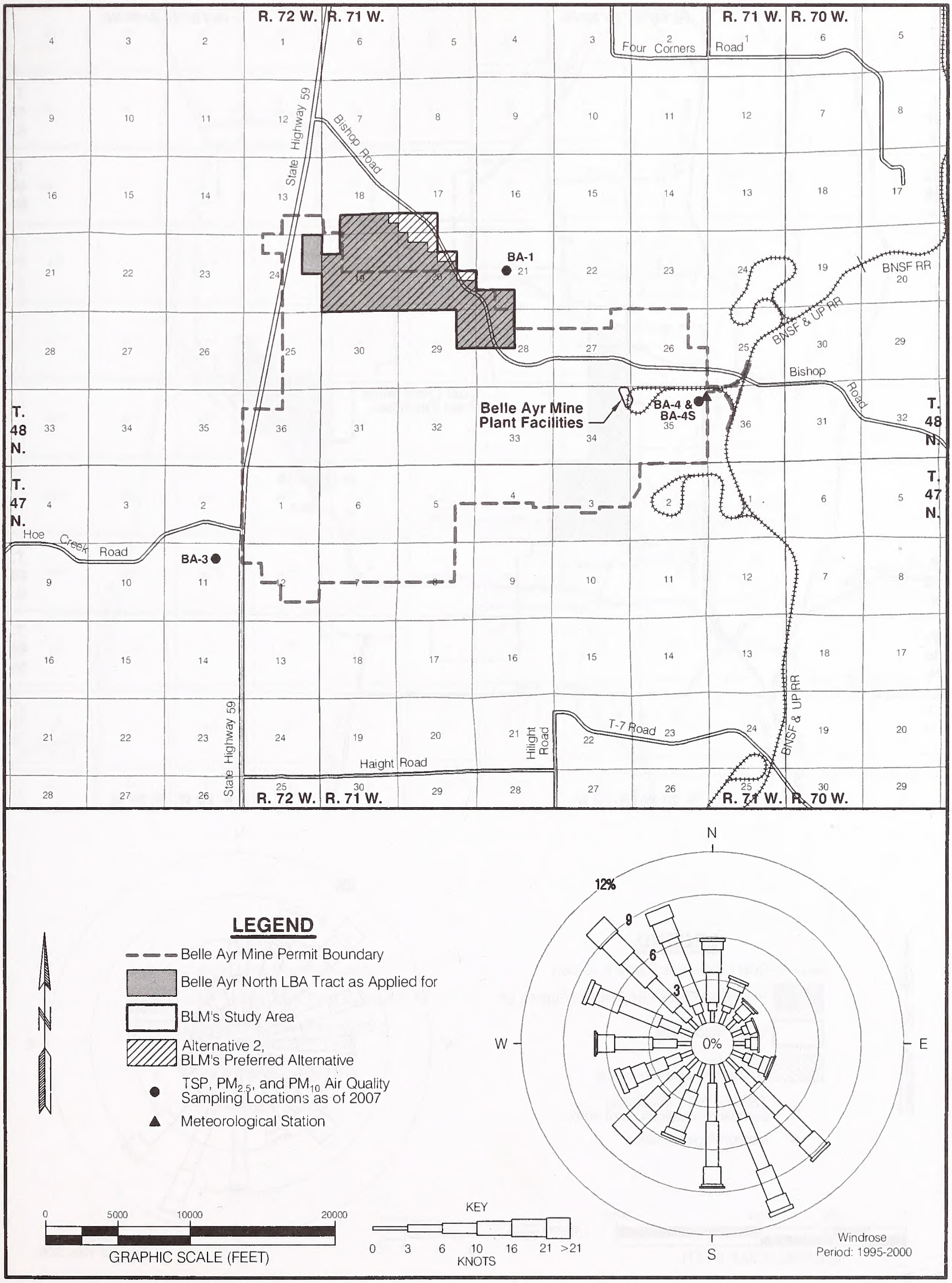


Figure 3-3. Wind Rose, Air Quality and Meteorological Stations at the Belle Ayr Mine.

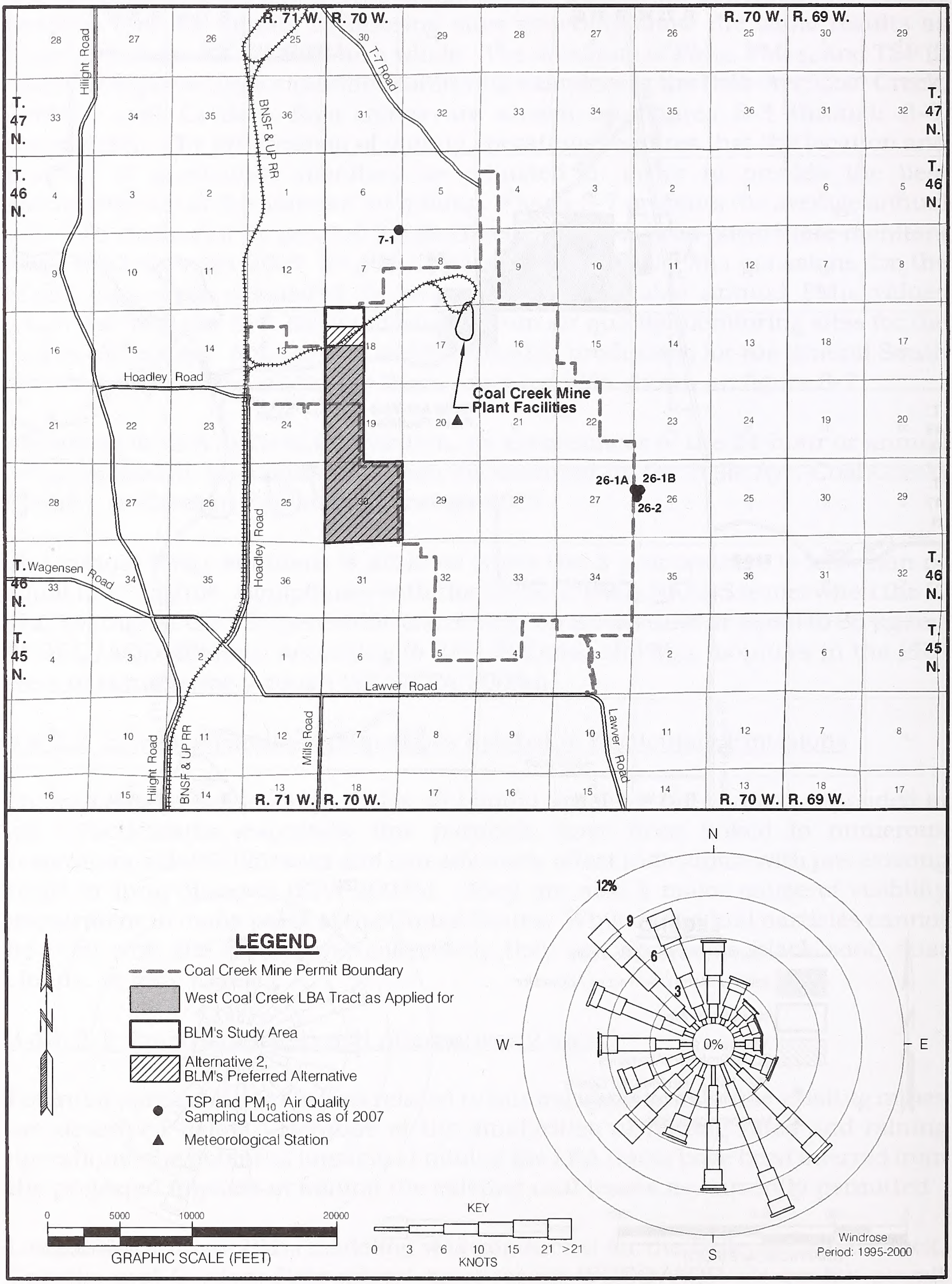


Figure 3-4. Wind Rose, Air Quality and Meteorological Stations at the Coal Creek Mine.

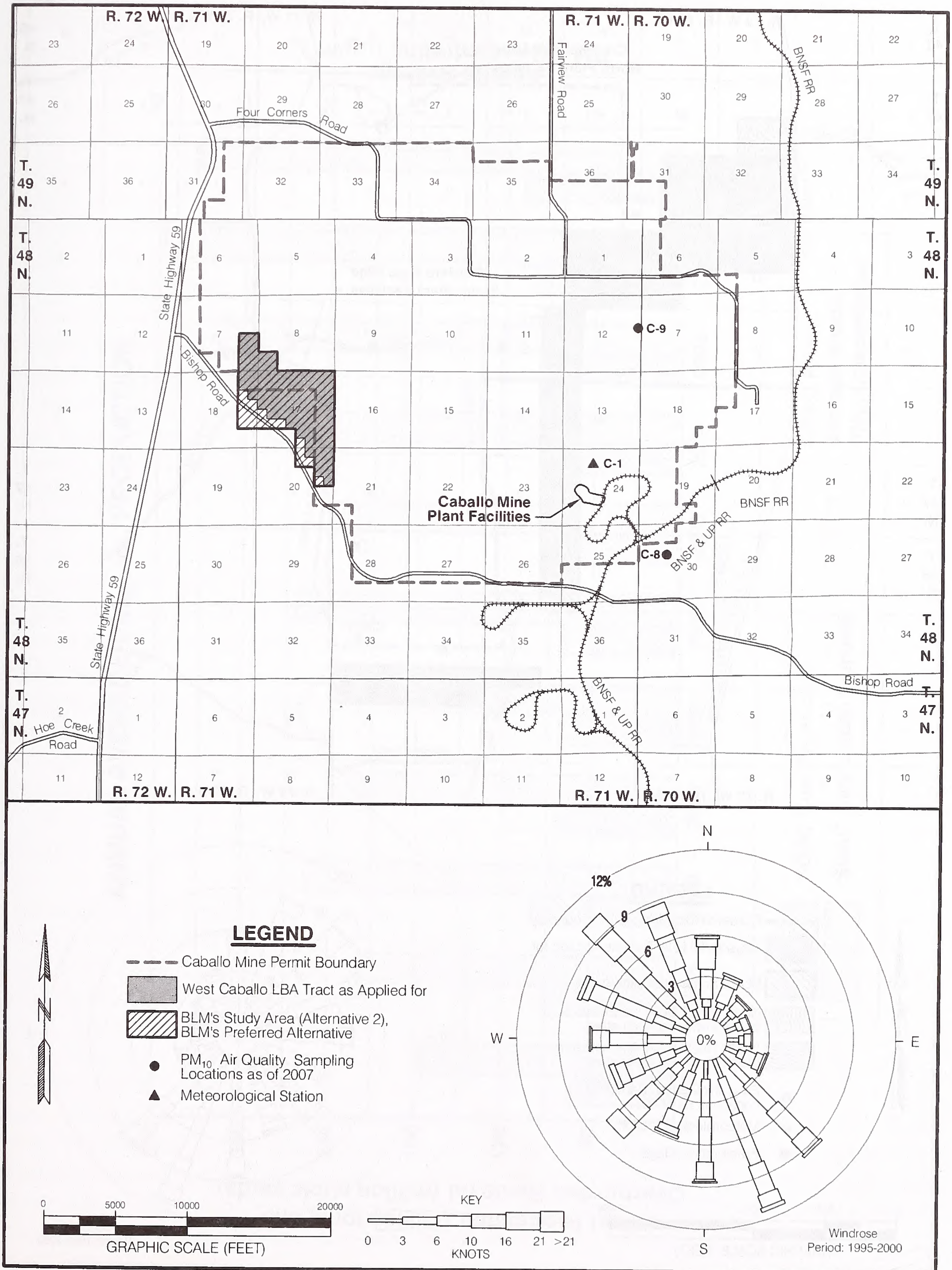


Figure 3-5. Wind Rose, Air Quality and Meteorological Stations at the Caballo Mine.

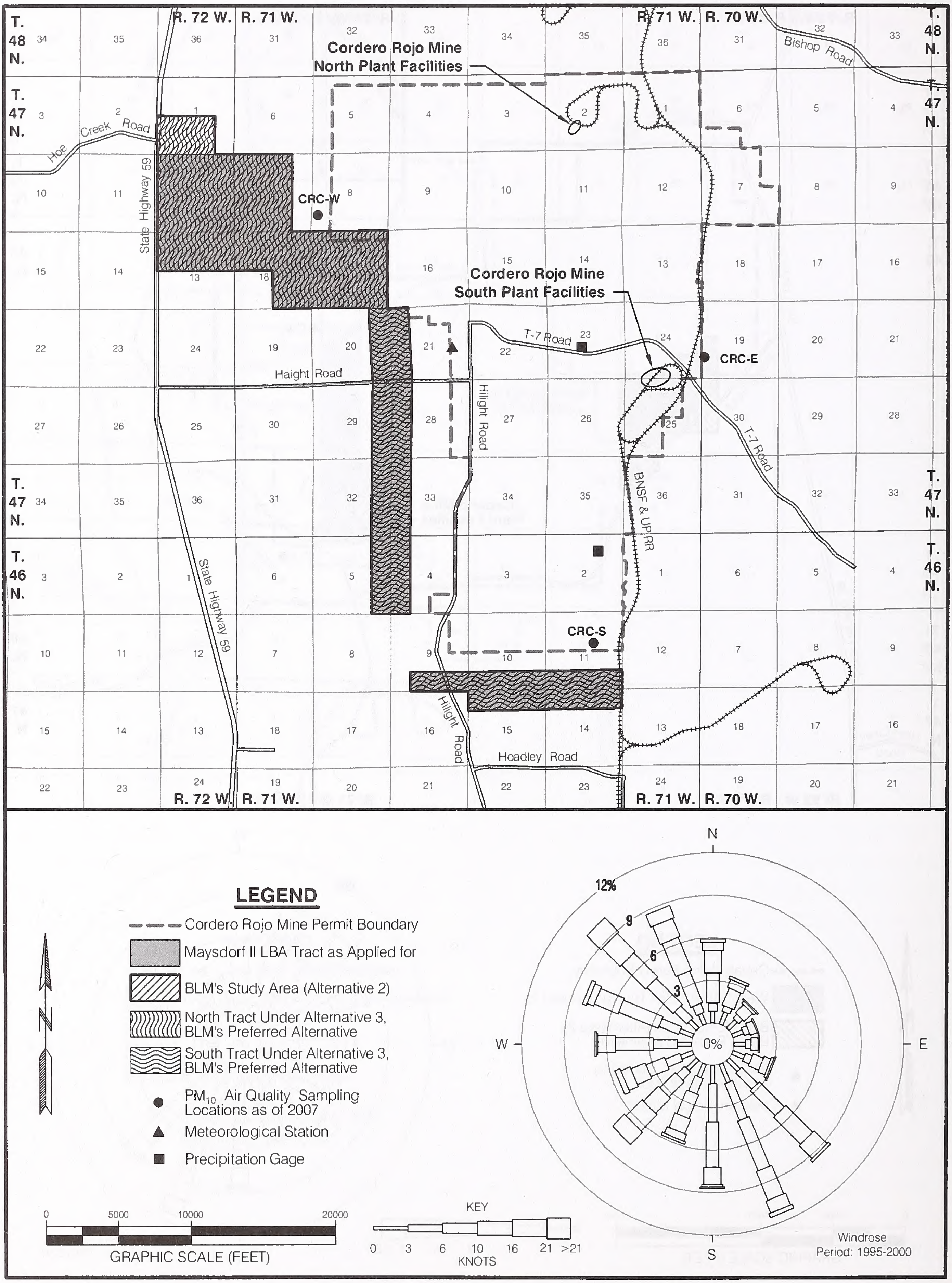


Figure 3-6. Wind Rose, Air Quality and Meteorological Stations at the Cordero Rojo Mine.

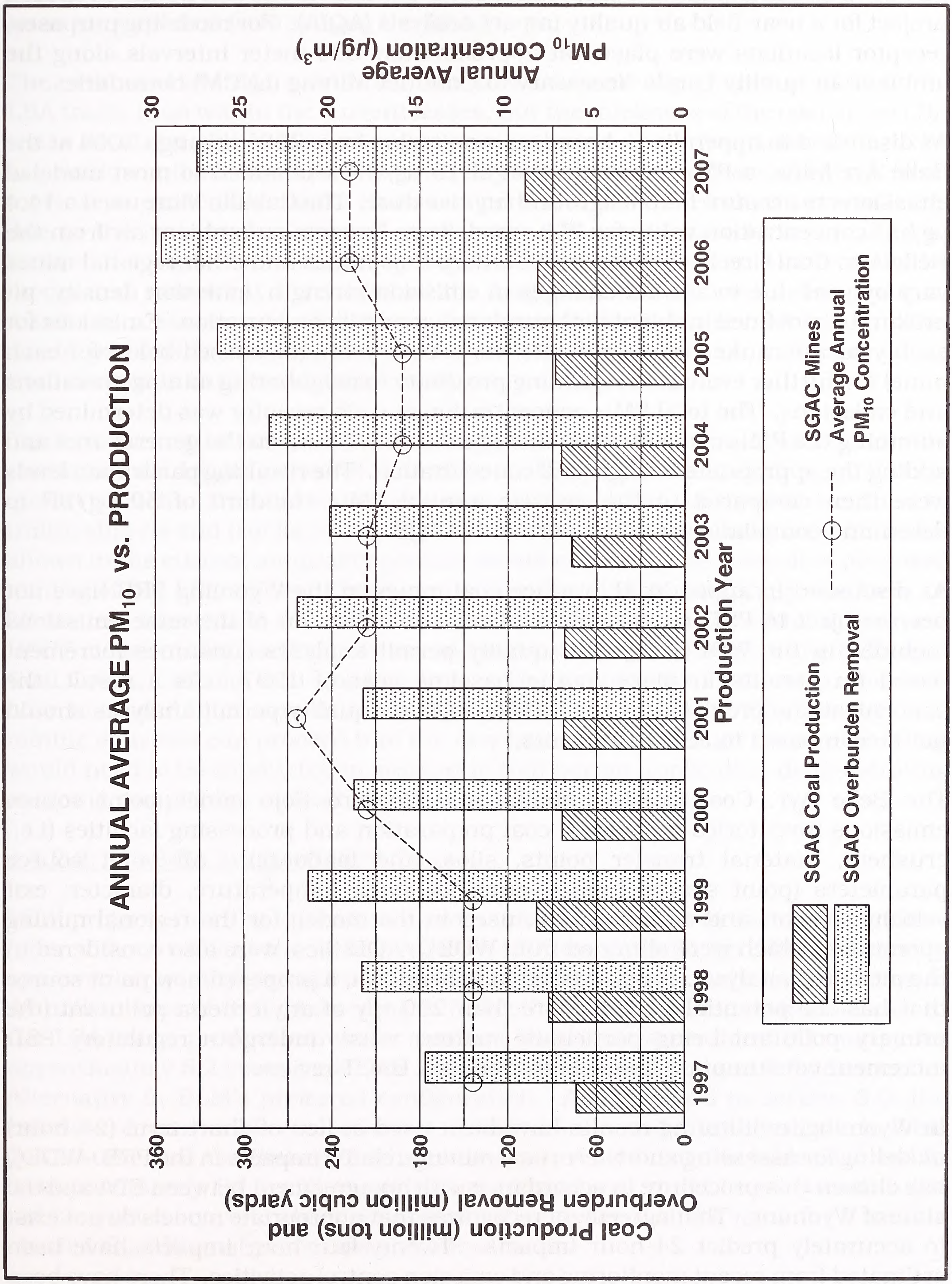


Figure 3-7. Annual Coal Production and Overburden Removal vs. Ambient Particulates for the General South Gillette Analysis Area (1997 through 2007).

(ISCLT3) model to simulate dispersion of air pollutants emitted by the proposed project for a near-field air quality impact analysis (AQIA). For modeling purposes, receptor locations were placed at approximately 500-meter intervals along the ambient air quality Lands Necessary to Conduct Mining (LNCM) boundaries.

As discussed in appendix H, based on monitoring from 2001 through 2004 at the Belle Ayr Mine, a PM_{10} concentration of 15 $\mu g/m^3$ was added to most modeled emissions to account for background fugitive dust. The Caballo Mine used a 14.4 $\mu g/m^3$ concentration value for PM_{10} modeling. Impacts on ambient air from the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines and other regional mines vary by year due to annual changes in emission strength, emission density, pit proximity to defined ambient air boundaries, and pit configuration. Emissions for each year are ranked and candidate worst-case years (discussed below for each mine) are further evaluated regarding proximity to neighboring mining operations and emissions. The total PM_{10} concentration at each receptor was determined by summing the PM_{10} concentration due to each active mine in the general area and adding the appropriate background concentration. The resulting particulate levels were then compared to the average annual PM_{10} standard of 50 $\mu g/m^3$ to determine compliance with the annual WAAQS.

As discussed in appendix H, surface coal mines in the Wyoming PRB have not been subject to PSD requirements. Only some fraction of the mine emissions included in the WDEQ/AQD air quality permit analyses consumes increment based on permits in place in the baseline year of 1997. As a result, the concentrations predicted by the WDEQ/AQD air quality permit analyses should not be compared to PSD increments.

The Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines point source emissions inventories include all coal preparation and processing facilities (i.e., crushers, material transfer points, silos, and loadouts). All point source parameters (point source inputs, such as stack temperature, diameter, exit velocity, height, and emission rate, used in the model) for the regional mining operations, which were obtained from WDEQ/AQD files, were also considered in the modeling analysis. As discussed in appendix H, a proposed new point source that has the potential to emit more than 250 tpy of any criteria pollutant (the primary pollutant being particulate matter) must undergo a regulatory PSD increment consumption analysis as well as a BACT review.

In Wyoming, monitoring results have been used in lieu of short-term (24-hour) modeling for assessing short-term coal mining-related impacts in the PRB. WDEQ has chosen this procedure in accordance with an agreement between EPA and the state of Wyoming. That agreement recognizes that appropriate models do not exist to accurately predict 24-hour impacts. Twenty-four-hour impacts have been estimated from recent monitoring and emission control activities. There have been no violations for exceeding the 24-hour or annual ambient air standards at the

Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines through August 2007 and none are expected from mining the LBA tracts.

The estimated average overburden thickness is generally greater in each of the LBA tracts than within the current leases, but the thickness of the coal in the LBA tracts is about the same as in the existing mine areas (see table 3-5). The acquisition and mining of the LBA tracts by the applicant mines could result in an increase in particulate matter emissions per ton of coal mined above current levels due to the increased volume of overburden that would have to be removed to recover the coal. The increase in fugitive dust emissions could potentially be moderated somewhat if removal of the larger volume of overburden material results in a slower rate of mining advancement through the LBA tracts. This would potentially decrease the number of acres disturbed annually and cause haul distances to increase more slowly.

Current mining techniques (i.e., haulage, blasting, etc.) would be expected to continue for a longer period of time than is shown in the currently approved air quality permits. Material movement of overburden and coal would continue to utilize shovels and trucks in overburden and shovels and trucks in coal. Facilities shown in the current air quality permits would not change as a result of proposed mining of the LBA tracts. There are no plans to change blasting procedures or blast sizes associated with the mining of the LBA tracts. In addition, current BACT measures for particulates would continue to be employed. If the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines acquire the LBA tracts, they will have to amend their current air quality permits to include the new leases before mining activities can proceed into the new lease areas. New air quality modeling would need to be conducted in support of that permit application demonstrating on-going compliance with all applicable ambient standards.

<u>3.4.2.2.1.1 Belle Ayr North LBA Tract</u>

FCW projects that the annual coal production is expected to average 30 million tons, with or without the Belle Ayr North LBA tract. Belle Ayr Mine's currently approved air quality permit from the WDEQ/AQD limits annual coal production to 45 million tons of coal. According to FCW, if they acquire the additional coal in the LBA tract, production would continue at an average rate of 30 mmtpy for approximately 5.2 years under the Proposed Action, or for about 5.0 years under Alternative 2, BLM's preferred configuration. As discussed in section 3.0, the estimate of recoverable coal, associated disturbance, and mine life shown in table 3-1 assume that the Bishop Road is not moved. As indicated in tables 2-2 and 2-3, approximately 54.5 million additional tons of coal could be recovered if this public road is moved, which would extend operations at the mine for a total of about 1.8 additional years under Alternative 2.

WDEQ/AQD issued air quality permit MD-1271 for the Belle Ayr Mine on November 18, 2005. This air quality permit was issued based on an analysis

using emission factors, estimation methods, and model selection consistent with WDEQ/AQD policy. WDEQ/AQD issued air quality permit MD-1476 on September 7, 2006 to modify operations at the Belle Ayr Mine and to increase permitted annual production to 45 mmtpy (FCW 2007).

Particulate emission inventories for the mining activities at Belle Ayr Mine were prepared for all years in the currently anticipated life of the mine. Two years were then selected for worst-case dispersion modeling of PM_{10} based on mine plan parameters and emission inventories. Fugitive emission sources and point sources were modeled using the ISCLT3 Model to estimate average annual PM_{10} concentrations.

McVehil-Monnett Associates, Inc. reviewed regulatory modeling techniques to select the most appropriate air quality dispersion model to simulate dispersion of air pollutants emitted by the proposed project for a near-field AQIA. Following WDEQ guidance, the ISCLT3 was used in all modeling analyses. Long-term modeling indicates the currently projected mine activities will be in compliance with the annual PM_{10} ambient air standard for the life of the Belle Ayr Mine. Based on mine plan parameters and highest emissions inventories, the years 2008 and 2013 were selected as the worst-case years. The dispersion model showed a maximum concentration on the Belle Ayr LNCM boundary of 39.79 $\mu g/m^3$ in 2008 and 42.02 $\mu g/m^3$ in 2013. Coal production in both years was modeled at the maximum permitted production level of 45 million tons (FCW 2006). The locations of the maximum-modeled PM_{10} concentrations for 2008 and 2013 are shown on figures 3-8 and 3-9, respectively.

An inventory of all point sources, controls, and emissions for the MD-1476 air quality permit showed a maximum potential to emit 61.5 tpy; therefore, a PSD increment consumption analysis was not necessary. Because this value is below the 100 tpy major source threshold limit specified in Chapter 6, Section 3 of the WAQSR, Belle Ayr Mine will not be subject to the Title V Operating Permit program (FCW 2006).

ISCLT3 modeling conducted for the current Belle Ayr Mine permit predicted no exceedances of the annual PM_{10} NAAQS at a 45-mmtpy production rate and there have been no exceedances of the 24-hour and annual PM_{10} NAAQS. FCW estimates that the mine would produce at an average annual rate of 30 mmtpy if it acquires and mines the Belle Ayr North LBA tract. At that average rate of production, there would be an extension of over 5 years in the time the mine would produce and there would be an increase in overburden thickness, but fugitive dust emissions are projected remain within daily and annual AAQS limits.

Public exposure to particulate emissions from surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. There are occupied dwellings and school bus stops located in the vicinity

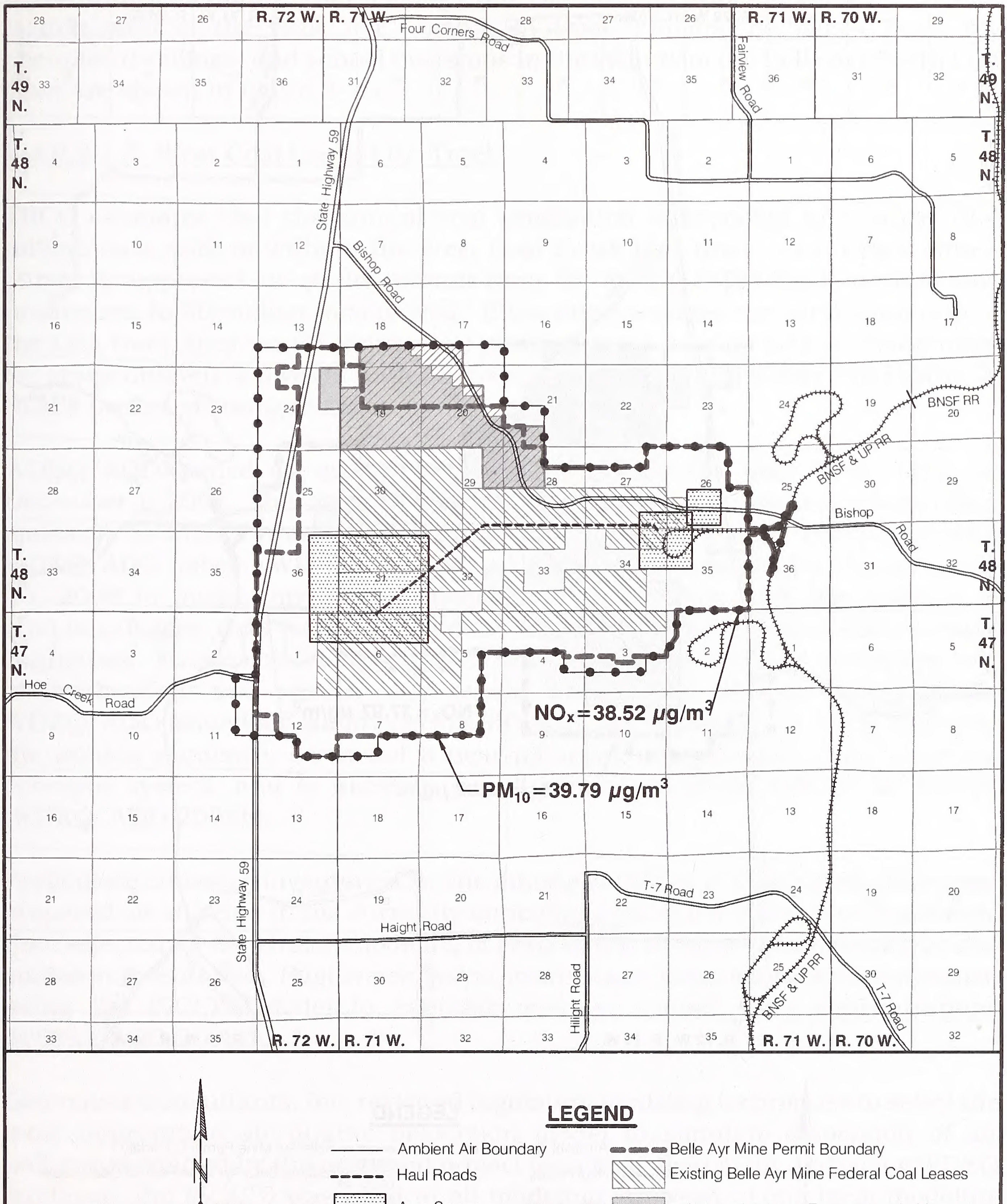


Figure 3-8. Maximum Modeled PM_{10} and NO_X Concentrations at the Belle Ayr Mine Ambient Air Boundary for the Year 2008.

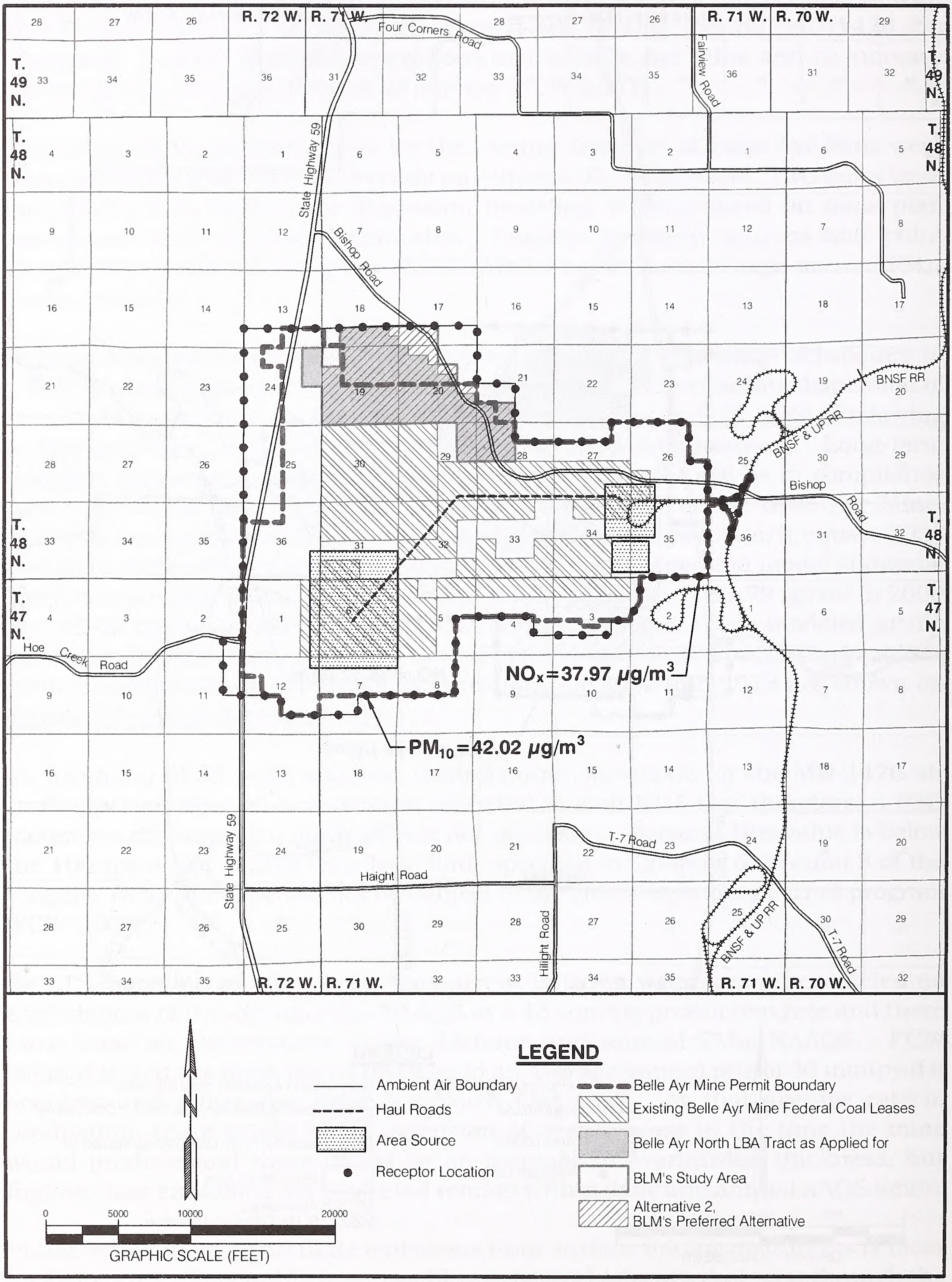


Figure 3-9. Maximum Modeled PM_{10} and NO_X Concentrations at the Belle Ayr Mine Ambient Air Boundary for the Year 2013.

of the mines, including several along State Highway 59, which is located less than ¼-mile west of the Belle Ayr North LBA tract. Roads, highways, currently occupied dwellings, and school bus stops in the vicinity of the Belle Ayr North LBA tract are shown in figure 3-10.

3.4.2.2.1.2 West Coal Creek LBA Tract

TBCC estimates that the annual coal production is expected to average 13.4 million tons, with or without the West Coal Creek LBA tract. Coal Creek Mine's currently approved air quality permit from the WDEQ/AQD limits annual coal production to 50 million tons of coal. If the mine acquires the additional coal in the LBA tract, they would continue to produce at an average rate of 13.4 mmtpy for approximately 4.3 years under the Proposed Action and under Alternative 2, BLM's preferred configuration.

WDEQ/AQD issued air quality permit MD-1282 for the Coal Creek Mine on December 1, 2005. This air quality permit was issued based on an analysis using emission factors, estimation methods, and model selection consistent with WDEQ/AQD policy. WDEQ/AQD issued air quality permit MD-1343 on March 30, 2006 to modify operations at the Coal Creek Mine with the addition of atomizer/fogger dust control systems, which replaced existing conventional baghouses. Material movement utilizes draglines, shovels, and trucks for removal of overburden, and shovels and trucks for removal of coal (TBCC 2005). WDEQ/AQD issued air quality permit MD-5393 on September 2, 2008 to modify the mining sequence, construct a near-pit truck dump/crusher and overland conveyor system, and to increase permitted annual production to 50 mmtpy (WDEQ/AQD 2008b).

Particulate emission inventories for the mining activities at Coal Creek Mine were prepared for all years in the currently anticipated life of the mine. Two years were then selected for dispersion modeling of PM_{10} based on mine plan parameters and emission inventories. Fugitive emission sources and point sources were modeled using the ISCLT3 Model to estimate average annual PM_{10} concentrations (WDEQ/AQD 2008b).

Geomatrix Consultants, Inc. reviewed regulatory modeling techniques to select the most appropriate air quality dispersion model to simulate dispersion of air pollutants emitted by the proposed project for a near-field AQIA. Following WDEQ guidance, the ISCLT3 was used in all modeling analyses. Long-term modeling indicates the currently projected mine activities will be in compliance with the annual PM_{10} ambient air standard for the life of the Coal Creek Mine. Based on mine plan parameters and highest emissions inventories, the years 2009 and 2016 were selected as the worst-case years. The dispersion model showed a maximum concentration on the Coal Creek LNCM boundary of 32.7 $\mu g/m^3$ in 2009 and 38.9 $\mu g/m^3$ in 2016. Coal production in both years was projected to be the maximum permitted production level of 50 million tons (WDEQ/AQD 2008b).

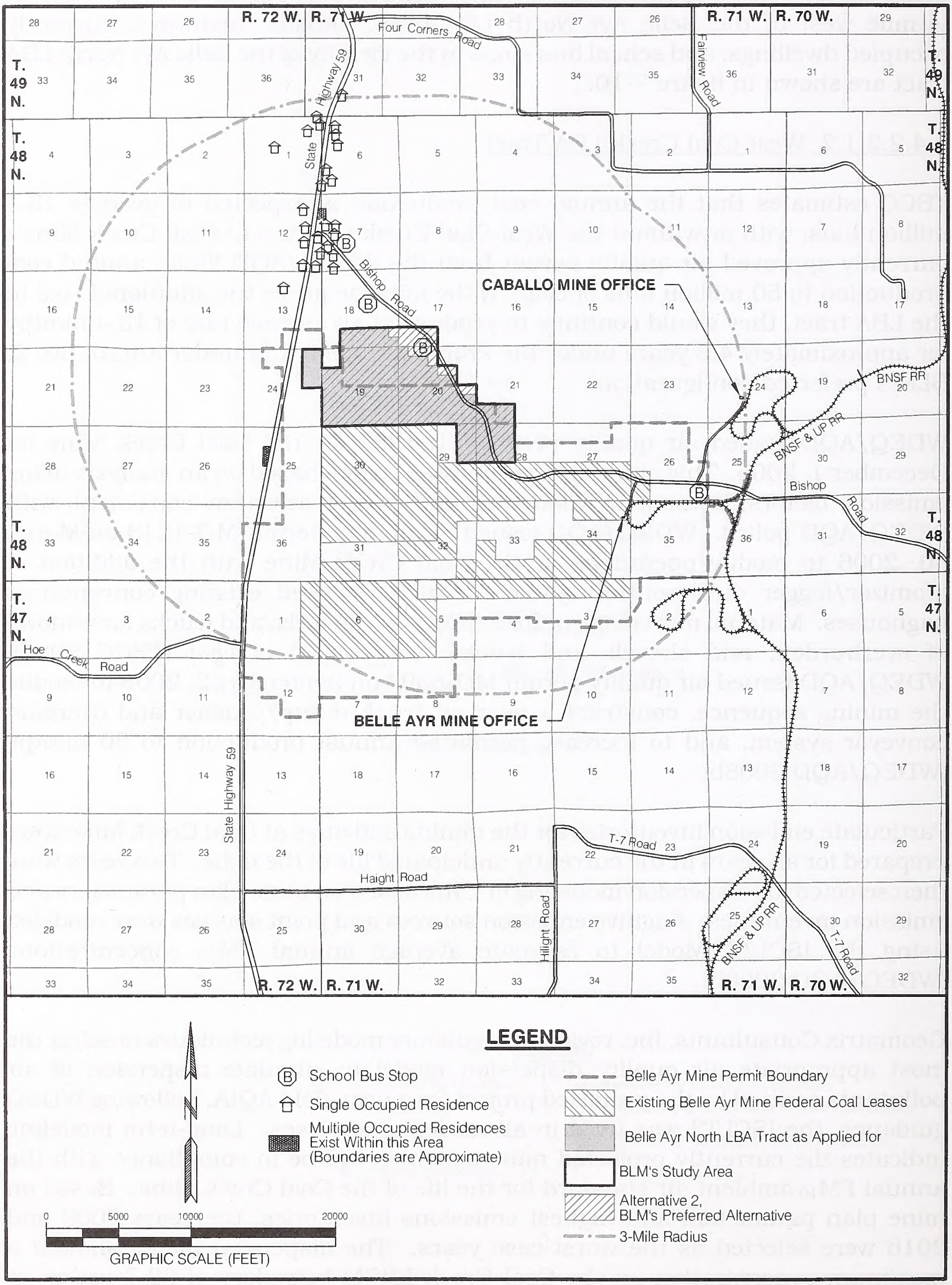


Figure 3-10. Residences, School Bus Stops, Public Roads, and Other Publicly Accessible Facilities Within 3 Miles of the Belle Ayr North LBA Study Area.

The locations of the maximum-modeled PM_{10} concentrations for 2009 and 2016 are shown on figures 3-11 and 3-12, respectively.

An inventory of all point sources, controls, and emissions for the MD-5393 air quality permit showed a potential to emit 34.4 tpy; therefore, a PSD increment consumption analysis was not necessary. Because this value is below the 100 tpy major source threshold limit specified in Chapter 6, Section 3 of the WAQSR, Coal Creek Mine will not be subject to the Title V Operating Permit program (WDEQ/AQD 2008b).

ISCLT3 modeling conducted for the current Coal Creek Mine permit predicted no exceedances of the annual PM_{10} NAAQS at a 50-mmtpy production rate and there have been no exceedances of the 24-hour and annual PM_{10} NAAQS. TBCC estimates that the mine would produce at an average annual rate of 13.4 mmtpy if it acquires and mines the West Coal Creek LBA tract. At that average rate of production, there would be an extension of over 4 years in the time the mine would produce and there would be an increase in overburden thickness, but fugitive dust emissions are projected remain within daily and annual AAQS limits.

Public exposure to particulate emissions from surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. There are occupied dwellings and school bus stops located in the vicinity of the mine. Roads, highways, currently occupied dwellings, and school bus stops in the vicinity of the West Coal Creek LBA tract are shown in figure 3-13.

3.4.2.2.1.3 Caballo West LBA Tract

CCC projects that the annual coal production is expected to average 37.8 million tons, with or without the Caballo West LBA tract. Caballo Mine's currently approved air quality permit from the WDEQ/AQD limits annual coal production to 50 million tons of coal. If the mine acquires the additional coal in the LBA tract, they would continue to produce at an average rate of 37.8 mmtpy for approximately 2.2 years under the Proposed Action, or for about 2.5 years under Alternative 2, BLM's preferred configuration. As discussed in section 3.0, the estimates of recoverable coal, associated disturbance, and mine life shown in table 3-3 assume that the Bishop Road is not moved. As indicated in tables 2-5 and 2-6, approximately 6.9 million additional tons of coal could be recovered if this public road is moved, which would slightly extend operations at the mine under Alternative 2.

WDEQ/AQD issued air quality permit MD-1125 for the Caballo Mine on February 18, 2005. This air quality permit was issued based on an analysis using emission factors, estimation methods, and model selection consistent with WDEQ/AQD policy. WDEQ/AQD issued air quality permit MD-1477 on November 7, 2006 to modify operations at the Caballo Mine to increase the permitted production to 50

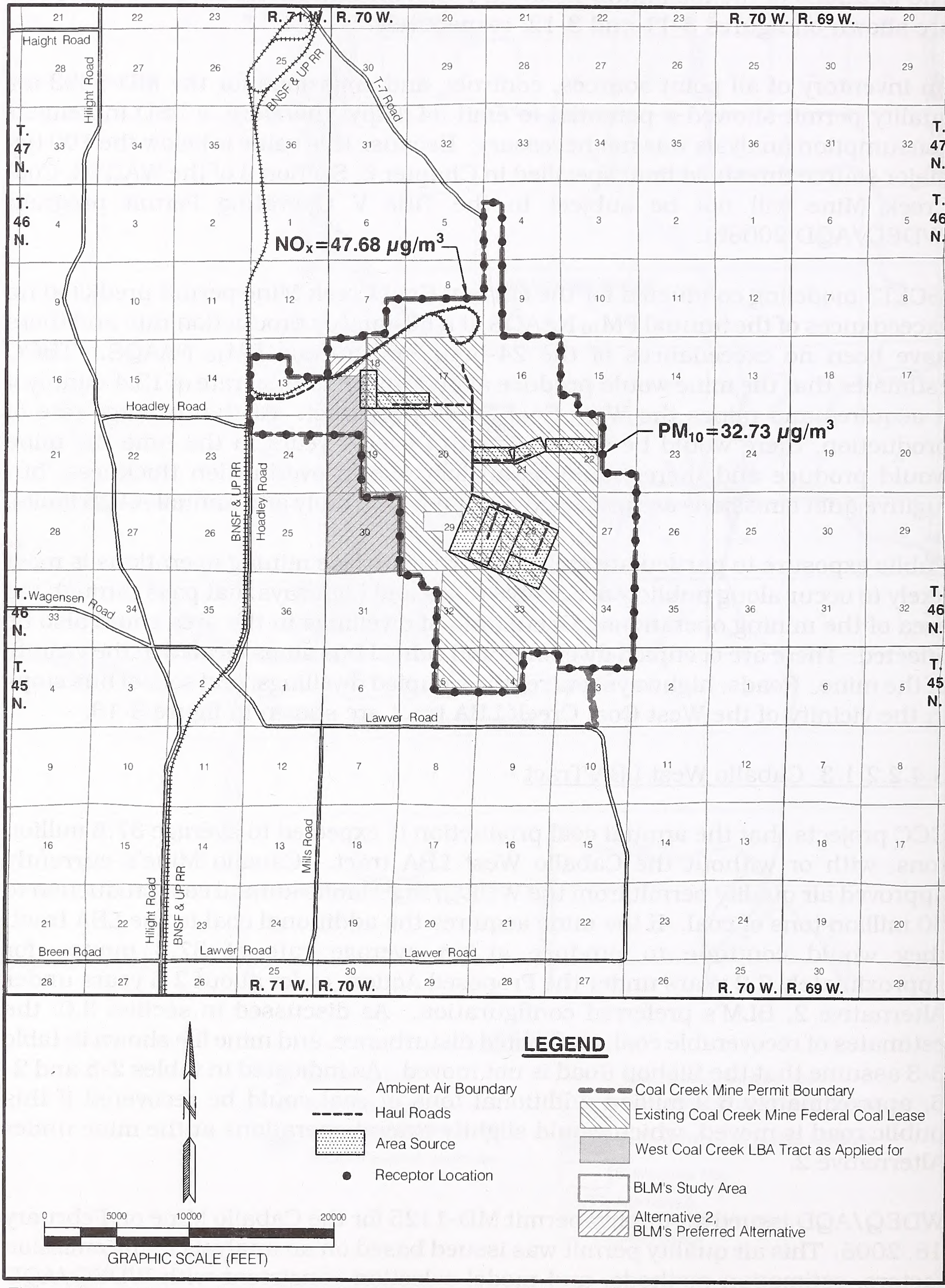


Figure 3-11. Maximum Modeled PM_{10} and NO_X Concentrations at the Coal Creek Mine Ambient Air Boundary for the Year 2009.

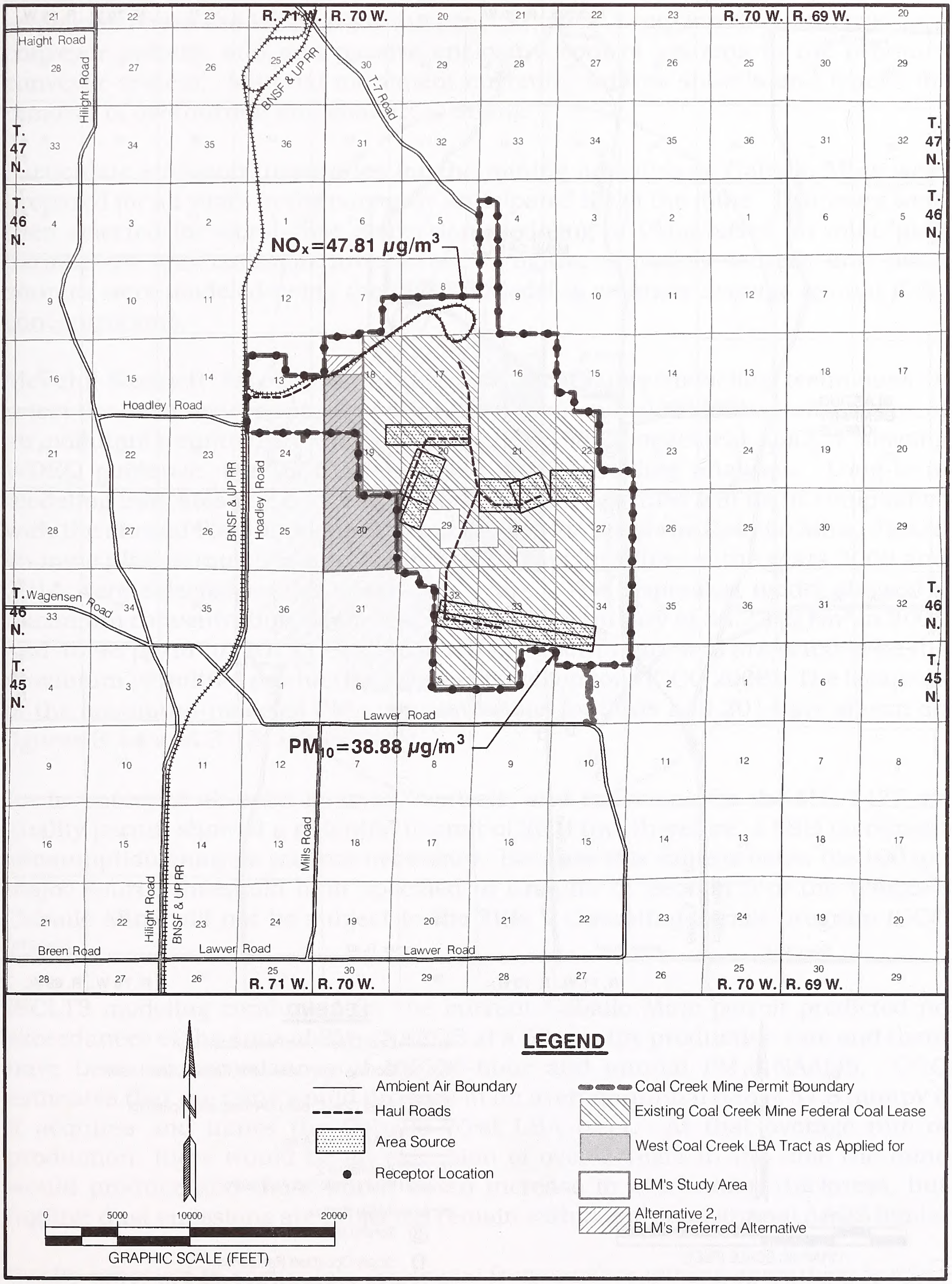


Figure 3-12. Maximum Modeled PM_{10} and NO_X Concentrations at the Coal Creek Mine Ambient Air Boundary for the Year 2016.

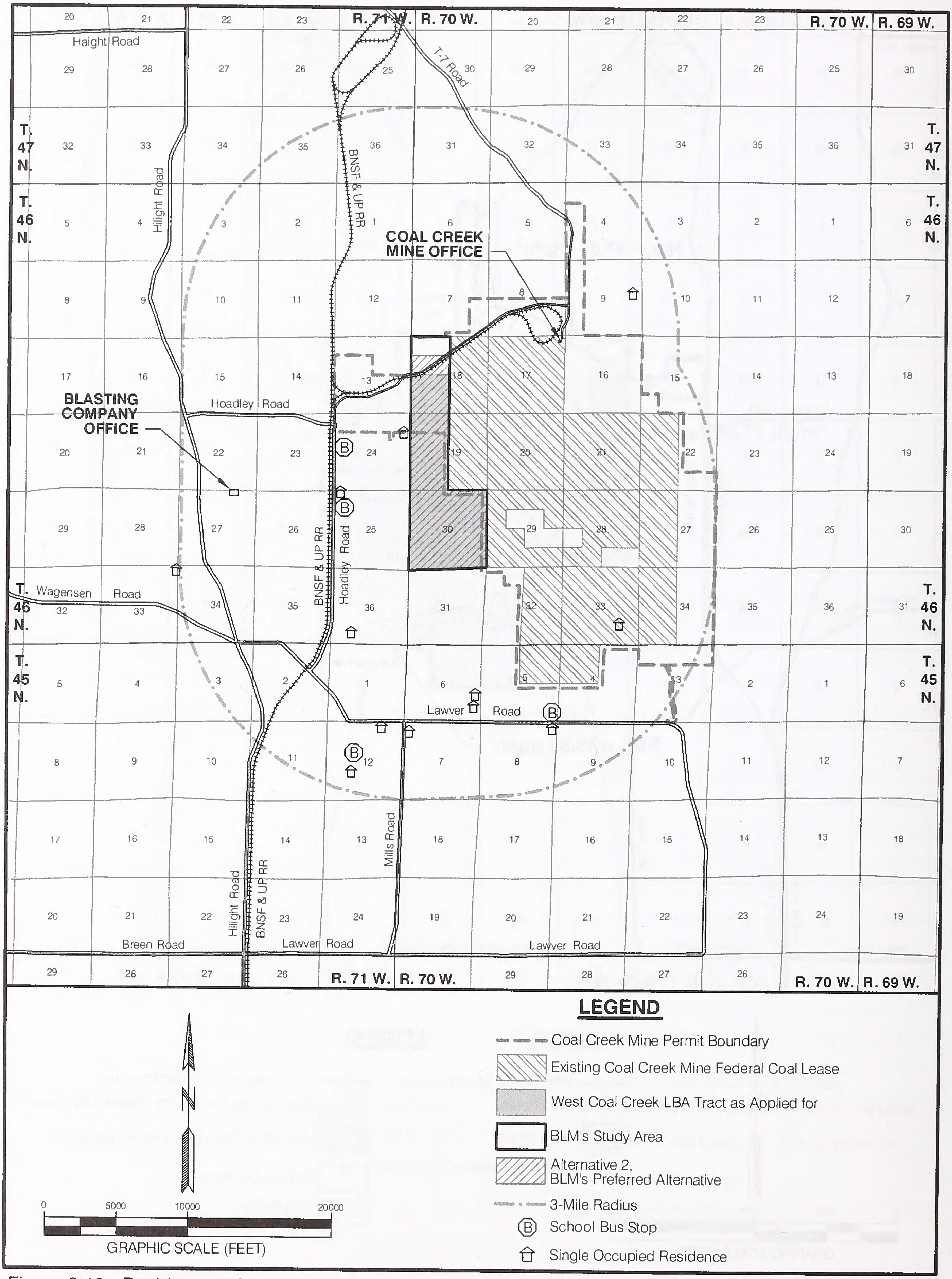


Figure 3-13. Residences, School Bus Stops, Public Roads, and Other Publicly Accessible Facilities Within 3 Miles of the West Coal Creek LBA Study Area.

mmtpy, add a dragline for overburden removal, revise the coal progression sequence, revise the location for the near-pit truck dump/crusher and overland conveyor system, and add passive enclosure control systems to the overland conveyor system. Material movement currently utilizes shovels and trucks for removal of overburden and coal (CCC 2006).

Particulate emission inventories for the mining activities at Caballo Mine were prepared for all years in the currently anticipated life of the mine. Two years were then selected for worst-case dispersion modeling of PM_{10} based on mine plan parameters and emission inventories. Fugitive emission sources and point sources were modeled using the ISCLT3 Model to estimate average annual PM_{10} concentrations.

McVehil-Monnett Associates, Inc. reviewed regulatory modeling techniques to select the most appropriate air quality dispersion model to simulate dispersion of air pollutants emitted by the proposed project for a near-field AQIA. Following WDEQ guidance, the ISCLT3 was used in all modeling analyses. Long-term modeling indicates the currently projected mine activities will be in compliance with the annual PM_{10} ambient air standard for the life of the Caballo Mine. Based on mine plan parameters and highest emissions inventories, the years 2008 and 2014 were selected as the worst-case years. The dispersion model showed a maximum concentration on the Caballo LNCM boundary of 36.77 $\mu g/m^3$ in 2008 and 46.98 $\mu g/m^3$ in 2014. Coal production in both years was projected to be the maximum permitted production level of 50 million tons (CCC 2006). The locations of the maximum-modeled PM_{10} concentrations for 2008 and 2014 are shown on figures 3-14 and 3-15, respectively.

An inventory of all point sources, controls, and emissions for the MD-1477 air quality permit showed a potential to emit of 26.3 tpy; therefore, a PSD increment consumption analysis was not necessary. Because this value is below the 100 tpy major source threshold limit specified in Chapter 6, Section 3 of the WAQSR, Caballo Mine will not be subject to the Title V Operating Permit program (CCC 2006).

ISCLT3 modeling conducted for the current Caballo Mine permit predicted no exceedances of the annual PM_{10} NAAQS at a 50-mmtpy production rate and there have been no exceedances of the 24-hour and annual PM_{10} NAAQS. CCC estimates that the mine would produce at an average annual rate of 37.8 mmtpy if it acquires and mines the Caballo West LBA tract. At that average rate of production, there would be an extension of over 2 years in the time the mine would produce and there would be an increase in overburden thickness, but fugitive dust emissions are projected remain within daily and annual AAQS limits.

Public exposure to particulate emissions from surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be

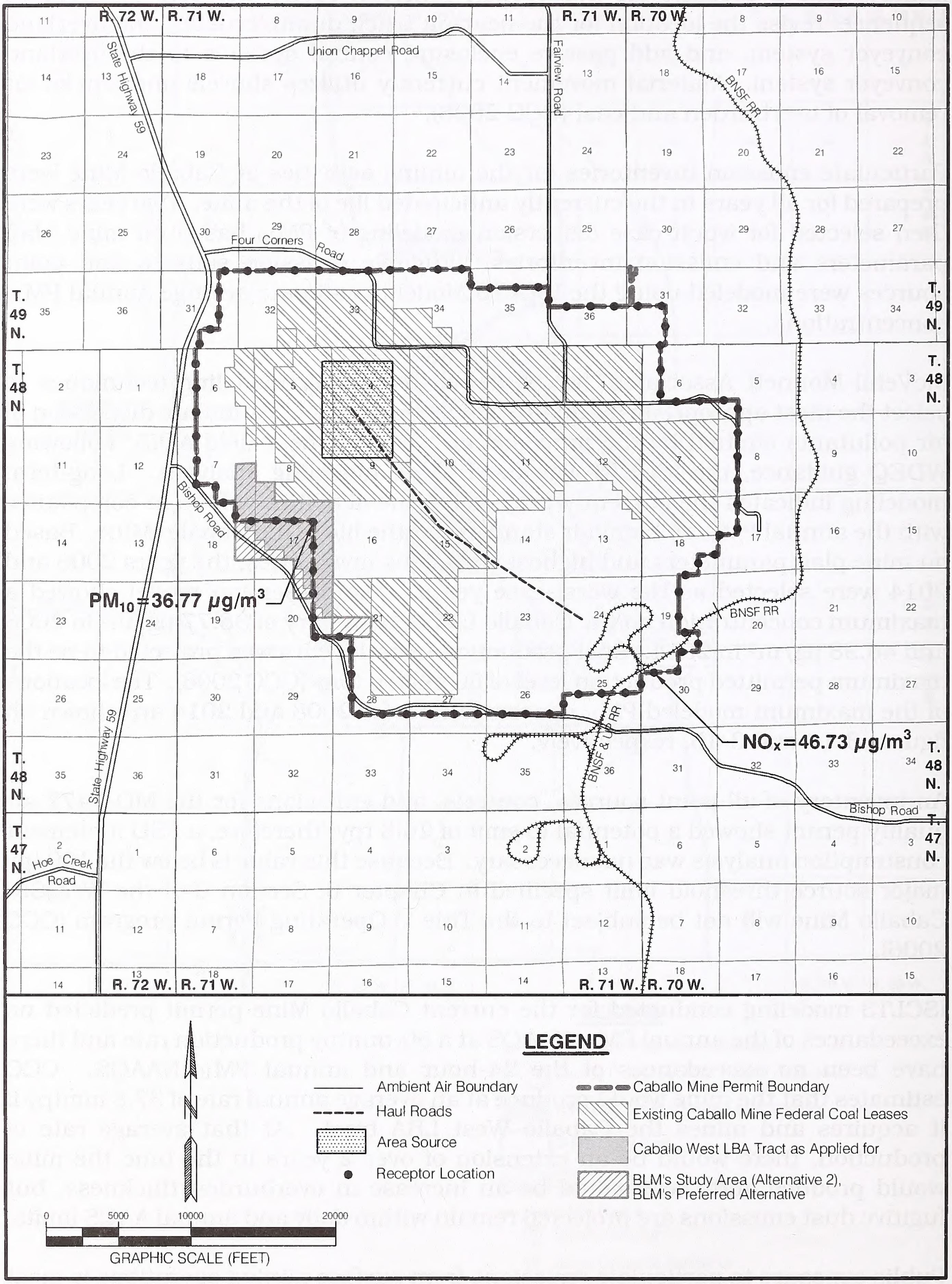


Figure 3-14. Maximum Modeled PM_{10} and NO_x Concentrations at the Caballo Mine Ambient Air Boundary for the Year 2008.

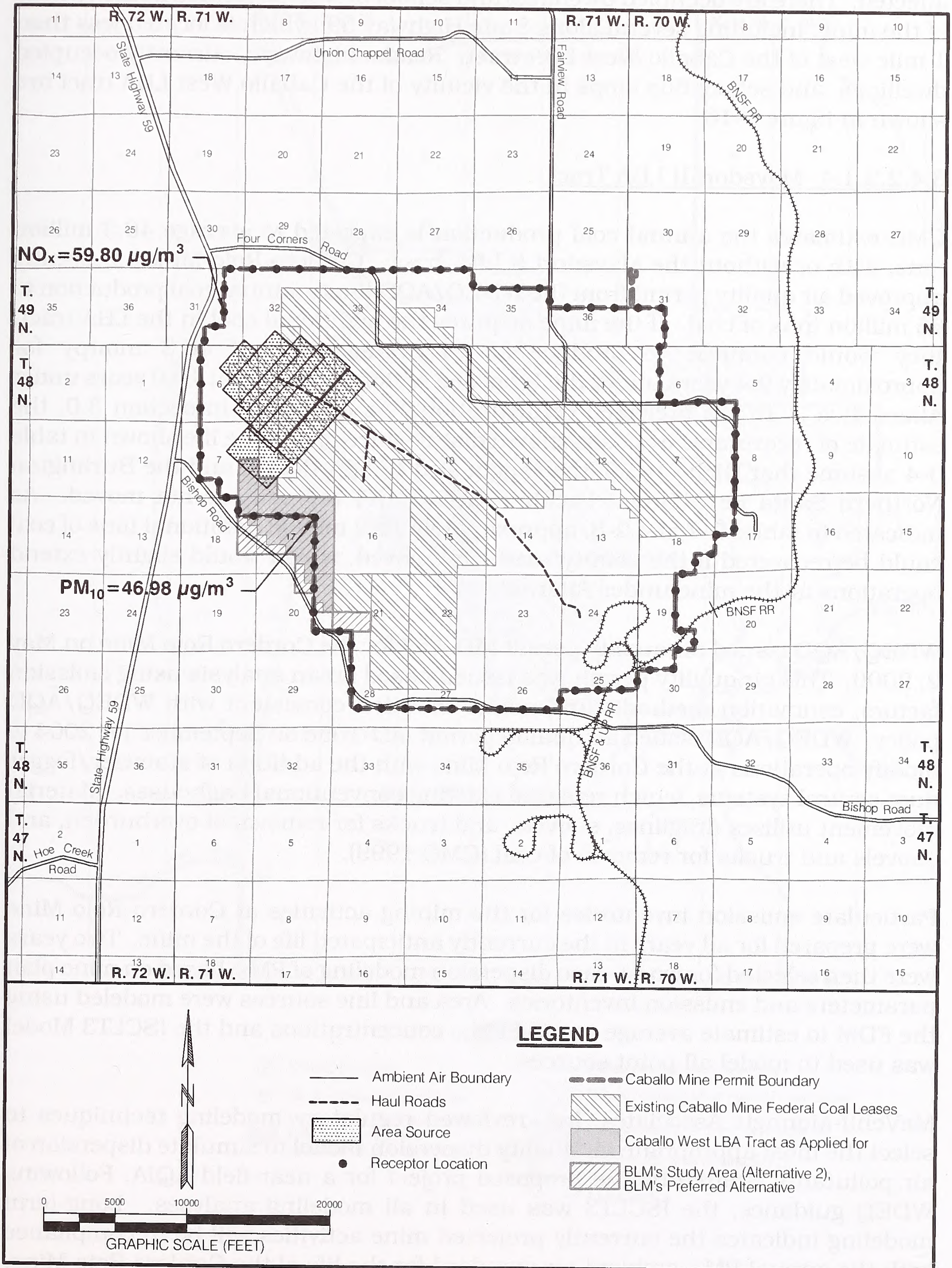


Figure 3-15. Maximum Modeled PM_{10} and NO_x Concentrations at the Caballo Mine Ambient Air Boundary for the Year 2014.

affected. There are occupied dwellings and school bus stops located in the vicinity of the mine, including several along State Highway 59, which is located less than 1 mile west of the Caballo West LBA tract. Roads, highways, currently occupied dwellings, and school bus stops in the vicinity of the Caballo West LBA tract are shown in figure 3-16.

3.4.2.2.1.4 Maysdorf II LBA Tract

CMC estimates the annual coal production is expected to average 46.3 million tons, with or without the Maysdorf II LBA tract. Cordero Rojo Mine's currently approved air quality permit from the WDEQ/AQD limits annual coal production to 65 million tons of coal. If the mine acquires the additional coal in the LBA tract, they would continue to produce at an average rate of 46.3 mmtpy for approximately 9.4 years under the Proposed Action, or for about 10.0 years under Alternative 3, BLM's preferred configuration. As discussed in section 3.0, the estimate of recoverable coal, associated disturbance, and mine life shown in table 3-4 assume that Highway 59, the Haight and Hilight Roads, and the Burlington Northern Santa Fe & Union Pacific (BNSF & UP) railroad are not moved. As indicated in tables 2-7 and 2-8, approximately 15.2 million additional tons of coal could be recovered if the county roads are moved, which would slightly extend operations at the mine under Alternative3.

WDEQ/AQD issued air quality permit MD-457 for the Cordero Rojo Mine on May 2, 2000. This air quality permit was issued based on an analysis using emission factors, estimation methods, and model selection consistent with WDEQ/AQD policy. WDEQ/AQD issued air quality permit MD-1058 on September 17, 2004 to modify operations at the Cordero Rojo Mine with the addition of atomizer/fogger dust control systems, which replaced existing conventional baghouses. Material movement utilizes draglines, shovels, and trucks for removal of overburden, and shovels and trucks for removal of coal (CMC 1999).

Particulate emission inventories for the mining activities at Cordero Rojo Mine were prepared for all years in the currently anticipated life of the mine. Two years were then selected for worst-case dispersion modeling of PM_{10} based on mine plan parameters and emission inventories. Area and line sources were modeled using the FDM to estimate average annual PM_{10} concentrations and the ISCLT3 Model was used to model all point sources.

McVehil-Monnett Associates, Inc. reviewed regulatory modeling techniques to select the most appropriate air quality dispersion model to simulate dispersion of air pollutants emitted by the proposed project for a near-field AQIA. Following WDEQ guidance, the ISCLT3 was used in all modeling analyses. Long-term modeling indicates the currently projected mine activities will be in compliance with the annual PM_{10} ambient air standard for the life of the Cordero Rojo Mine. Based on mine plan parameters and highest emissions inventories, the years 2005 and 2007 were selected as the worst-case years. The dispersion model showed a

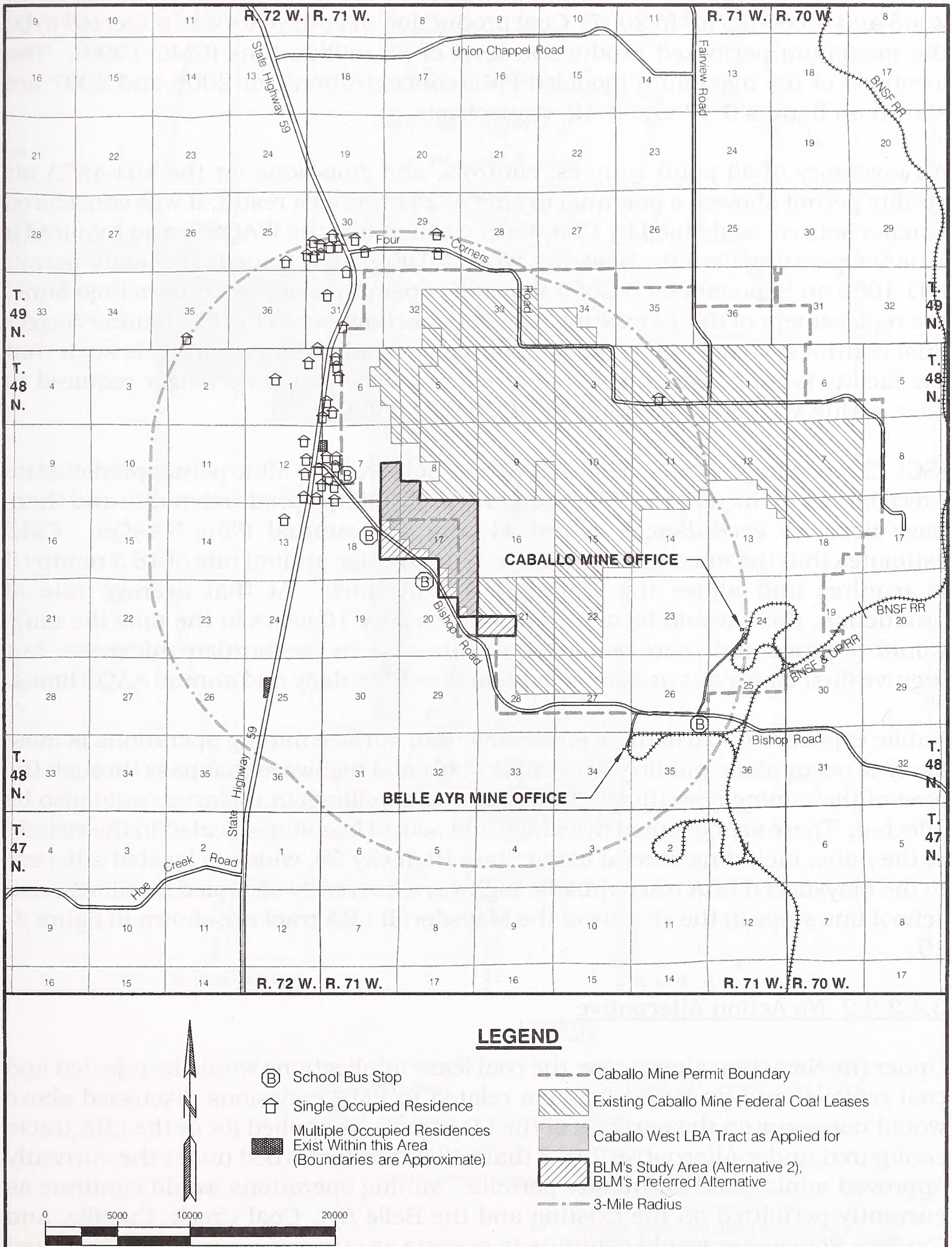


Figure 3-16. Residences, School Bus Stops, Public Roads, and Other Publicly Accessible Facilities Within 3 Miles of the Caballo West LBA Study Area.

maximum concentration on the Cordero Rojo LNCM boundary of 46.56 μg/m³ in 2005 and 45.66 μg/m³ in 2007. Coal production in both years was projected to be the maximum permitted production level of 65 million tons (CMC 1999). The locations of the maximum-modeled PM_{10} concentrations for 2005 and 2007 are shown on figures 3-17 and 3-18, respectively.

An inventory of all point sources, controls, and emissions for the MD-457A air quality permit showed a potential to emit of 241 tpy; as a result, it was considered a major source, as defined by Chapter 6, Section 3 of the WAQSR, and required a Title V Operating Permit. However, when WDEQ/AQD issued air quality permit MD-1058 on September 17, 2004 to modify operations at the Cordero Rojo Mine, the replacement of the 14 existing conventional baghouses by the atomizer/fogger dust control systems reduced point source particulate emission levels such that the facility is no longer considered a major source and is no longer required to have a Title V Operating Permit (WDEQ/AQD 2004).

ISCLT3 modeling conducted for the current Cordero Rojo Mine permit predicted no exceedances of the annual PM_{10} NAAQS at a 65-mmtpy production rate and there have been no exceedances of the 24-hour and annual PM_{10} NAAQS. CMC estimates that the mine would produce at an average annual rate of 46.3 mmtpy if it acquires and mines the Maysdorf II LBA tract. At that average rate of production, there would be an extension of nearly 10 years in the time the mine would produce and there would be an increase in overburden thickness, but fugitive dust emissions are projected remain within daily and annual AAQS limits.

Public exposure to particulate emissions from surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. There are occupied dwellings and school bus stops located in the vicinity of the mine, including several along State Highway 59, which is located adjacent to the Maysdorf II LBA tract. Roads, highways, currently occupied dwellings, and school bus stops in the vicinity of the Maysdorf II LBA tract are shown in figure 3-19.

3.4.2.2.2 No Action Alternative

Under the No Action alternative, the coal lease applications would be rejected and coal removal and projected impacts related to PM_{10} emissions discussed above would not occur on the portions of the LBA tracts as applied for or the LBA tracts configured under Alternative 2 or 3 that will not be disturbed under the currently approved mining and air quality permits. Mining operations would continue as currently permitted on the existing and the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines would continue to operate as currently permitted. Projected impacts related to PM_{10} emissions would not be extended onto those portions of the LBA tracts that will not be affected under the mines' current mining and reclamation plans.

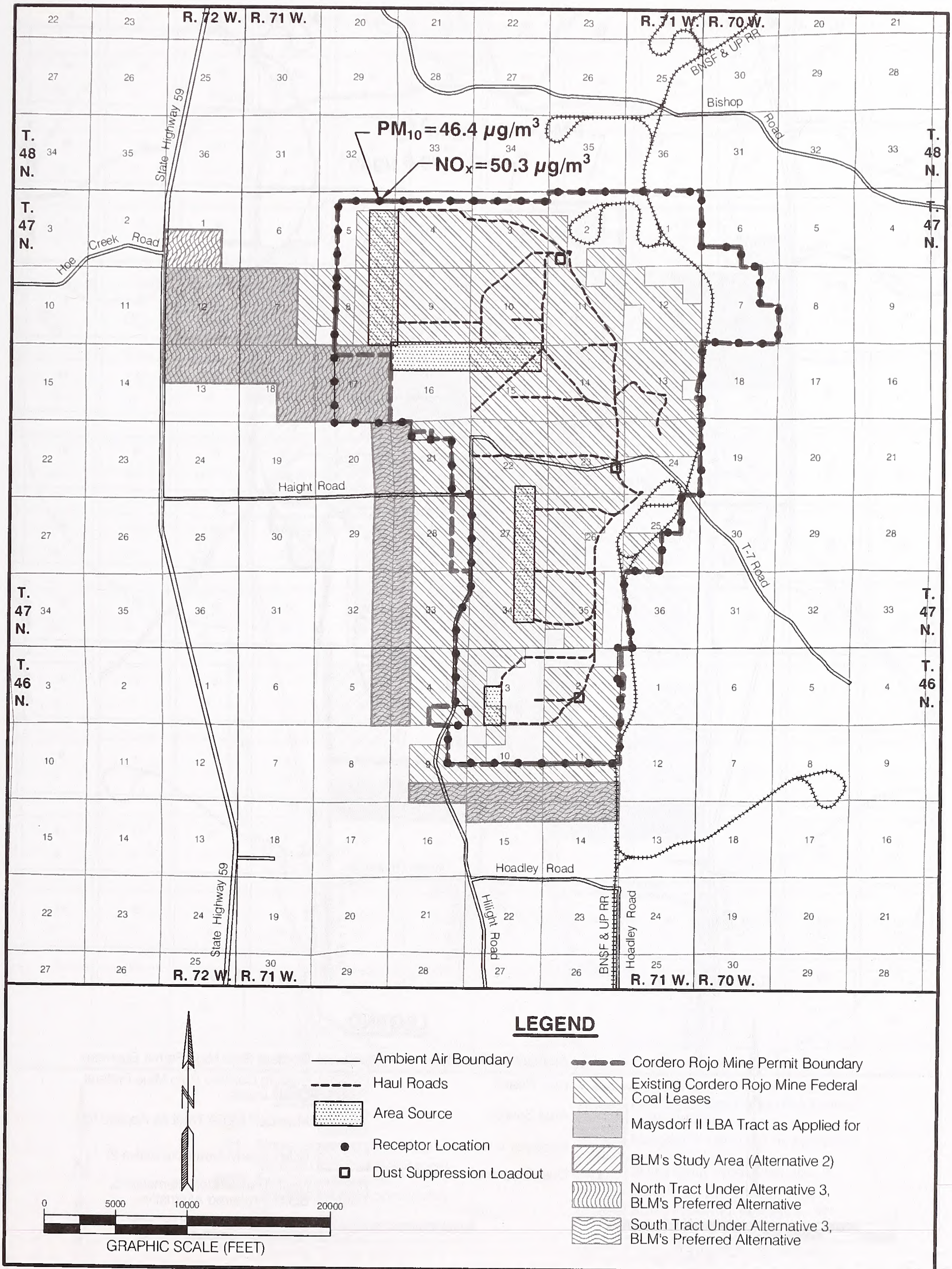


Figure 3-17. Maximum Modeled PM_{10} and NO_x Concentrations at the Cordero Rojo Mine Ambient Air Boundary for the Year 2005.

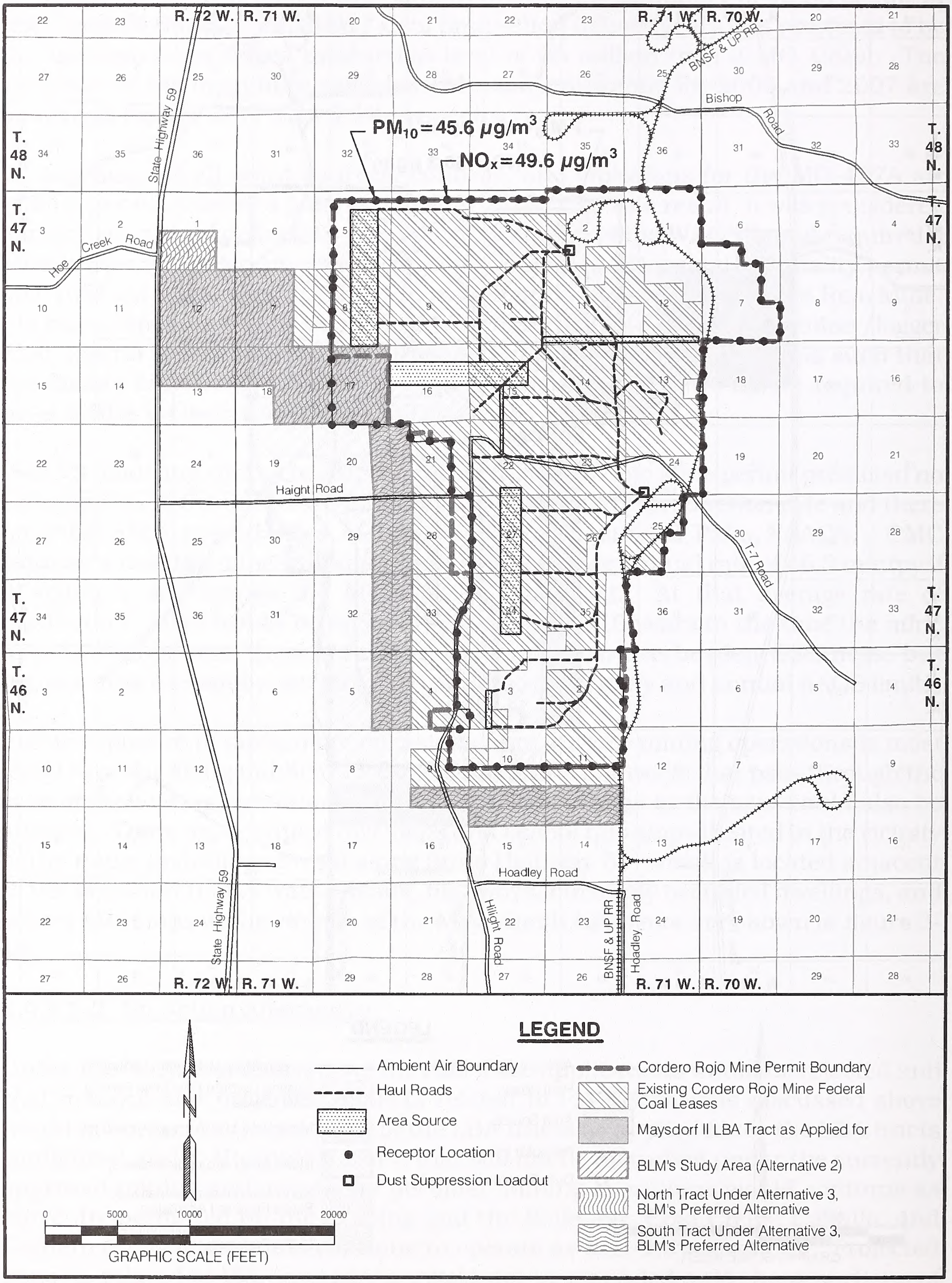


Figure 3-18. Maximum Modeled PM_{10} and NO_x Concentrations at the Cordero Rojo Mine Ambient Air Boundary for the Year 2007.

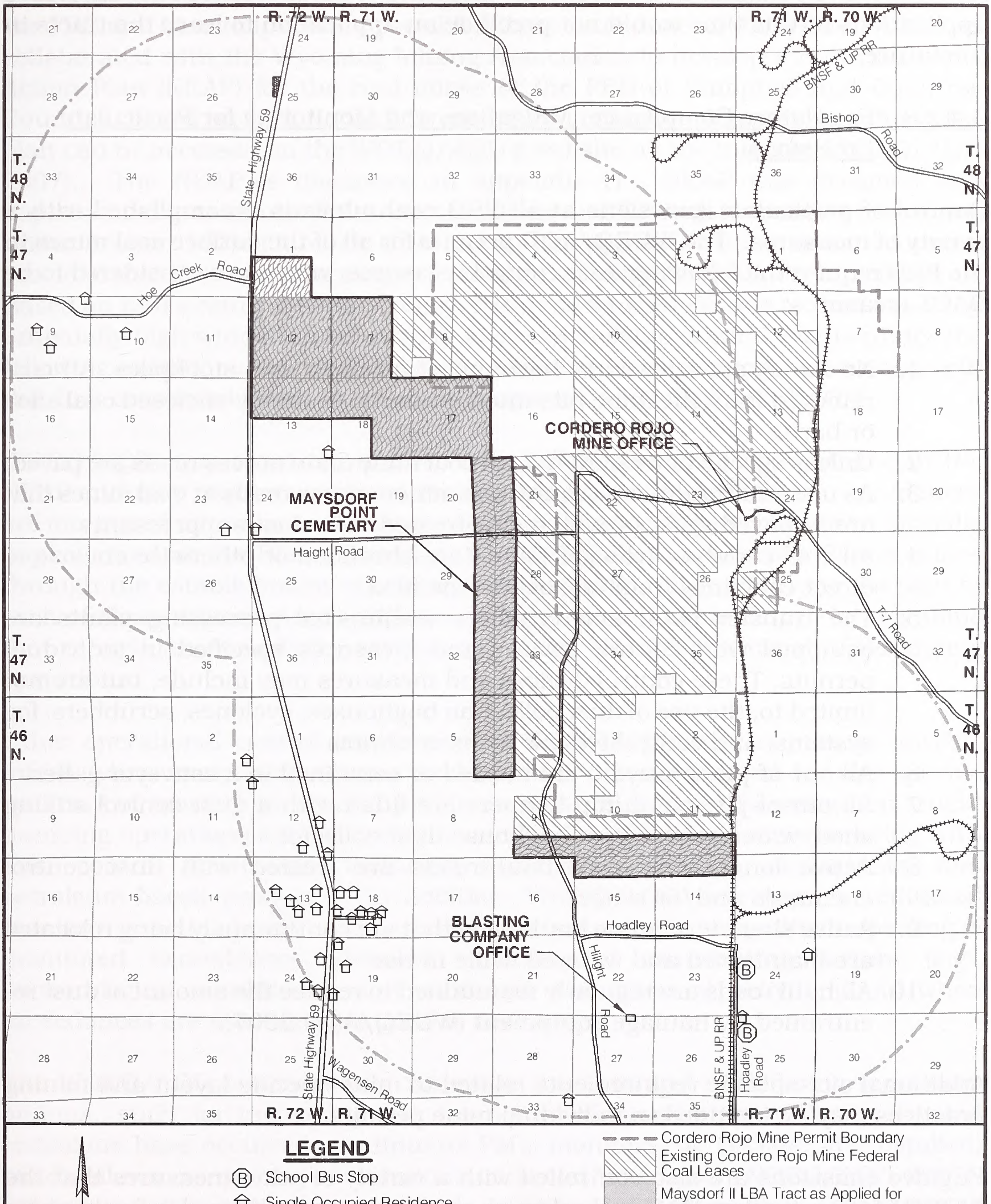


Figure 3-19. Residences, School Bus Stops, Public Roads, and Other Publicly Accessible Facilities Within 3 Miles of the Maysdorf II LBA Study Area.

As discussed in chapter 2, a decision to reject one or more of these four LBA lease applications at this time would not preclude an application to lease the tracts in the future.

3.4.2.3 Regulatory Compliance, Mitigation, and Monitoring for Particulate Emissions

Control of particulate emissions at all PRB coal mines is accomplished with a variety of measures. The WDEQ/AQD permits for all of the surface coal mines in the PRB require the following dust control measures, which are considered to be BACT measures:

1. No mines are allowed to have out-of-pit open coal stockpiles. All coal removed from the mine pits must be stored in totally enclosed coal silos or barns.
2. Unless specifically exempted, all coal mine main access roads are paved.
3. As use and condition warrant, the minor access roads at coal mines that are unpaved must be watered or treated with dust suppressants.
4. All coal conveyor transfer points are shrouded or otherwise enclose to direct coal fines from one belt to the next.
5. The transfer point and crushers within coal processing plants are equipped with control devices and measures specified in individual permits. These control devices and measures may include, but are not limited to, the use of dust collection baghouses, cyclones, scrubbers, fog systems, and controlled flow transfer chutes.
6. All out-of-pit conveyors are hooded or contained in a conveyor gallery.
7. All out-of-pit coal dump hoppers are fitted with a dust control stilling shed, water sprays, or a baghouse dust collector.
8. Active longer-term coal haul roads are treated with dust control chemicals and/or water.
9. Active short-term mine haul roads that are continuously being relocated are maintained and watered while in use.
10. All haul roads are regularly maintained to reduce the amount of dust re-entrained by haulage equipment (WDEQ/AQD 2007).

Additional site-specific requirements related to mine-specific layout and mining practices may be included in individual mine permits.

Fugitive emissions are also controlled with a variety of other measures that the WDEQ/AQD considers BACT. Haul truck speed limits are imposed to further help to reduce fugitive emissions from roads. Material drop heights for shovels and draglines (bucket to truck bed or backfill) are limited to the minimum necessary to conduct the mining operations. Timely temporary and permanent revegetation of disturbed areas is utilized to minimize wind erosion. All of these control measures are employed at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines.

In response to the measured exceedances of the PM_{10} NAAQS in certain areas of the PRB and in anticipation of possible future exceedances, the WDEQ/AQD has collaborated with the Wyoming Mining Association to develop a Natural Events Action Plan (NEAP) for the coal mines of the PRB of Campbell and Converse Counties, based on EPA Natural Event Policy guidance. A report describing the plan can be accessed on the WDEQ/AQD's website on the Internet (WDEQ/AQD 2007). The NEAP is discussed in appendix H. NEAP was designed and implemented to minimize PM_{10} concentrations and EPA will exercise its discretion, under Section 107(d)(3) of the CAA, not to redesignate areas as nonattainment, provided that the exceedances are demonstrated to be the result of natural events. Based on EPA's Natural Events Policy, PM_{10} concentrations due to dust raised by unusually high winds will be treated as uncontrollable natural events under the following conditions: 1) the dust originated from non-anthropogenic sources, or 2) the dust originated from anthropogenic sources controlled with BACM.

WDEQ/AQD may require implementation of the control steps outlined in the NEAP and may require continual evaluation of activity plans when exceedances are monitored at surface coal mines. Some of these measures have been formally implemented at the Black Thunder, North Rochelle, and Jacobs Ranch mines through the establishment of a formal, site-specific mitigative response plan at each of those mines. A mitigative response plan will be developed by any mine that records an exceedance or violation of the NAAQS downwind of its mining operations.

Other operational control measures that WDEQ/AQD may require at specific mines when exceedances occur include, but are not limited to, site-specific watering of inactive areas and problem areas; relocation of overburden truck-dumping operations and deferring blasting. The mines are experimenting with dust control treatments, including magnesium chloride, surfactants, and petroleum-based products. In addition, WDEQ/AQD may require additional monitoring, action levels based on continuous monitoring, expedited reporting of monitored exceedances, detailed reporting of contributing factors (e.g., meteorological conditions), and continual evaluation of activity plans when exceedances are monitored at surface coal mines.

The WDEQ/AQD is continually reviewing the data and considering regulatory options, such as increasing the frequency of monitoring. Where elevated emissions have occurred, continuous PM_{10} monitors, or TEOMs, are installed, which allows monitoring of emissions on a real-time basis (WDEQ/AQD 2007). Other regulatory options may include enforcement actions such as Notices of Violation resulting in a consent decree and/or modified permit conditions. WDEQ/AQD is also coordinating with EPA to develop additional monitoring requirements in CBNG development areas, high PM_{10} mitigation action plans in permits, and additional mitigation measures under the SIP.

The PRB has one of the most extensive networks of monitoring sites for PM_{10} in the nation; most of these monitoring sites are funded and operated by the mines. WDEQ/AQD requires the collection of information documenting the quality of the air resource at each of the PRB mines. A discussion of the monitoring network, monitoring requirements, the data that have been collected, and PM_{10} concentration trends since monitoring began are included in appendix H.

3.4.3 Emissions of Nitrogen Oxides (NO_X) and Ozone (O_3)

3.4.3.1 Affected Environment for NO_X and O_3 Emissions

Gases that contain nitrogen and oxygen in varying amounts are referred to as nitrogen oxides, or NO_X. One type of NO_X is nitrogen dioxide (NO_2), which is a highly reactive, reddish brown gas that is heavier than air and has a pungent odor. NO_2 is by far the most toxic of several species of NO_X. NO_2 can combine with atmospheric moisture to form nitric acid and nitric oxide. Because several NO_X species can be chemically converted to NO_2 in the atmosphere, NO_2 emissions control is focused on all NO_X species, while the ambient standard is expressed in terms of NO_2. O_3 has been included in discussions on emissions of NO_X since NO_X is one of the main ingredients involved in the formation of ground level O_3.

According to the EPA (EPA 2001a):

- NO_2 may cause significant toxicity because of its ability to form nitric acid with water in the eye, lung, mucous membranes, and skin.
- Acute exposure to NO_2 may cause death by damaging the pulmonary system.
- Chronic or repeated exposure to lower concentrations of NO_2 may exacerbate pre-existing respiratory conditions, or increase the incidence of respiratory infections.

Nitrogen oxides form when fuel is burned at high temperatures. They can be formed naturally or by human activities. The primary manmade sources are motor vehicles, electric utilities, and other fuel-burning sources. According to EPA, in 2002 motor vehicles/non-road equipment produced about 60 percent of the manmade NO_x emissions, utilities produced approximately 22 percent of the emissions, industrial/commercial/residential activities each produced about 17 percent of the manmade NO_x emissions, and other sources accounted for the remaining 1 percent of the manmade emissions (EPA 2009b).

The primary direct source of emissions of nitrogen oxides during coal mining operations is tailpipe emissions from large mining equipment and other vehicle traffic inside the mine permit area. Blasting that is done to assist in the removal of material overlying the coal (the overburden) can result in emissions of several

products, including NO_2, as a result of the incomplete combustion of nitrogen-based explosives used in the blasting process. When this occurs, gaseous, orange-colored clouds may be formed and they can drift or be blown off mine permit areas.

Incomplete combustion during blasting may be caused by wet conditions in the overburden, incompetent or fractured geological formations, deformation of boreholes, and blasting agent factors. The rate of release is not well known but is believed to be dependent on a wide number of factors that likely include, but are not necessarily limited to: downhole confinement; downhole moisture; type/blend of ammonium nitrate, fuel oil (ANFO) and emulsion; and detonation velocity. Generally, blasting-related NO_X emissions are more prevalent at operations that use the blasting technique referred to as cast blasting. Cast blasting refers to a type of direct blasting in which the blast is designed to cast the overburden from on top of the coal into the previously mined area. Coal Creek, Caballo, and Cordero Rojo mines currently employ direct cast blasting.

Annual mean NO_2 concentrations have been periodically measured in the PRB since 1975. NO_2 was monitored from 1975 through 1983 in Gillette and from March 1996 through April 1997 at four locations in the PRB. Table 3-7 summarizes the results of that monitoring.

Table 3-7. Annual Ambient NO_2 Concentration Data.

Site	Gillette, WY	Black Thunder Mine	Belle Ayr Mine	Bill, WY
Year	**Percent of Standard[1]**	**Percent of Standard[1]**	**Percent of Standard[1]**	**Percent of Standard[1]**
1975	6*			
1976	4*			1*
1977	4*			5*
1978	11*			
1979	11			
1980	12			
1981	14			
1982	11			
1983[2]	17			
1996-97[3]	16	16	22	22

1 Based on arithmetic averaging of data.
2 Monitoring discontinued December 1983, reactivated March 1996 to April 1997.
3 Arithmetic average – actual sampling ran from March 1996 to April 1997.
* Inadequate number of samples for a valid annual average.
Source: (McVehil-Monnett 1997)

Due to public concerns about emissions of nitrogen dioxides as a result of blasting and a general concern of the WDEQ about levels of nitrogen dioxides due to development of all types in the eastern PRB, the coal mining industry instituted a

monitoring network in cooperation with WDEQ/AQD to gather data on NO_2 beginning in 2001. Industry funded and operated the network for approximately 3 years. Ownership of the monitoring equipment was transferred to WDEQ by the mines and WDEQ now funds and operates the NO_2 monitoring network. The mines have been given ongoing access to the monitoring sites and provide electrical power for the instrumentation. WDEQ/AQD and the mines now share maintenance of these monitoring stations, and the AQD is relying on the ongoing monitoring data and emission inventories in the mines' air quality permit applications to demonstrate compliance with the annual NO_2 ambient air standard (table 3-6). The 2002 through 2008 data from this regional network are summarized in table 3-8. With respect to the general South Gillette analysis area, the Thunder Basin National Grassland Site is approximately 41 miles north-northeast, the South Campbell County Site is approximately 8 miles west, and the Tracy Ranch Site is approximately 29 miles southeast.

Table 3-8. 2002 Through 2008 Mean Annual NO_2 Concentration Data ($\mu g/m^3$).

Site Address	2002	2003	2004	2005	2006	2007	2008
Thunder Basin National Grassland[1]	5.7	5.7	3.8	3.8	3.8	3.8	3.8
Belle Ayr Mine[1]	--	13.2	13.2	15.1	17.0	--	--
Antelope Mine[1]	--	7.5	7.5	9.4	7.5	--	--
South Campbell County[1]	--	13.2	9.4	7.5	5.7	7.5	5.6
Tracy Ranch[2]	6.2	5.6	5.8	7.7	11.8	8.2	6.1
Average	5.95	9.04	7.94	8.70	9.16	6.50	5.17

[1] Monitor values from EPA (2009c)
[2] Monitor values from TBCC (2009)

O_3 has the same chemical structure whether it occurs miles above the earth or at ground-level and can be "good" or "bad," depending on its location in the atmosphere. In the earth's lower atmosphere, ground-level O_3 is considered "bad." Motor vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents as well as natural sources emit NO_X and VOC that help form O_3. Ground-level O_3 is the primary constituent of smog. Sunlight and hot weather cause ground-level O_3 to form in harmful concentrations in the air. As a result, it is known as a summertime air pollutant. Many urban areas tend to have high levels of "bad" O_3, but even rural areas are also subject to increased O_3 levels because wind carries O_3 and pollutants that form it hundreds of miles away from their original sources.

Under the Clean Air Act, EPA has set protective health-based standards for O_3 in the air we breathe. Prior to May 27, 2008, the NAAQ 8-hour standard for O_3 was 0.080 ppm (157 $\mu g/m^3$). On March 27, 2008 (effective May 27, 2008) EPA revised the 8-hour standard to 0.075 ppm (147 $\mu g/m^3$). Ozone monitoring is not required by WDEQ at the SGAC mines but levels have been monitored at WDEQ/AQD

operated and maintained ambient air quality monitor sites in the PRB since 2001 (table 3-9). An exceedance of the O_3 8-hour standard occurs if the 4th-highest daily maximum value is above the level of the standard (0.08 ppm prior to 2008 and 0.075 ppm since 2008).

Table 3-9. 2001 Through 2008 Annual 4th Max, 8-Hour Average O_3 Values[1] (ppm).

Site Address	2001	2002	2003	2004	2005	2006	2007	2008
Thunder Basin National Grassland	0.069	0.071	0.074	0.065	0.063	0.072	0.072	0.074
South Campbell County	--	--	0.077	0.061	0.063	0.065	0.072	0.064

[1] Monitor values from EPA (2009c)
Pre 2008 8-Hour O_3 NAAQS – 0.08 ppm
2008 8-Hour O_3 NAAQS – 0.075 ppm

3.4.3.1.1 Site Specific NO_X and O_3 Emissions

Sources of fugitive NO_X emissions at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines include overburden removal and coal blasting events, tailpipe emissions from the mining equipment, and emissions from the trains used to haul the coal from the mine. NO_X point sources at the mines could include stationary engines and natural-gas fired heaters.

To date, there have been no exceedances of the annual NO_2 standards documented at the five sites that monitor NO_2. There here have been no reported events of public exposure to NO_2 from blasting activities at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines. There were two reports of off-site NO_X clouds related to cast blasts at the Caballo Mine prior to September 2007 but no actual exposure complaints were reported (Emme 2009). The WDEQ has not required the mines to implement any specific measures to control or limit public exposure to NO_2 from blasting.

As noted in table 3-8, the 2008 mean annual NO_2 concentration (5.6 µg/m^3) for the site closest to the SGAC tract (South Campbell County Site) is significantly below the WAAQ annual standard for NO_2 (100 µg/m^3).

No exceedances of the O_3 standard have occurred at either of the two monitoring sites if evaluated under the standard in place at the time the values were recorded (table 3-9). If the strengthened 2008 standard was applied retroactively, one exceedance would have occurred in 2003 at the South Campbell County site (table 3-9).

3.4.3.1.1.1 Belle Ayr North LBA Tract

As discussed in section 3.4.2.2, WDEQ/AQD issued the most recent air quality permit (MD-1476) for the Belle Ayr Mine on November 7, 2006, and the mine was required to conduct NO_2 dispersion modeling in their permit. McVehil-Monnett

Associates, Inc. reviewed regulatory modeling techniques to select the most appropriate air quality dispersion model to simulate dispersion of air pollutants emitted by the proposed project for a near-field AQIA. Following WDEQ guidance, the ISCLT3 was used in all modeling analyses. Emission rates were determined for the same worst-case years used in the PM_{10} modeling. NO_X modeling closely followed many of the same procedures used in the PM_{10} analysis. Emissions were apportioned in a similar manner and the same meteorological data set was used. Area source, haul road, and point source information for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines and information for railroads, roads, power plants, and regional sources provided by WDEQ/AQD were included in the model. The amount of NO_X emissions from blasting is related to the amount of ANFO utilized. NO_X emission rates for 2008 and 2013 are expected to be 1,333 tpy and 1,398 tpy, respectively.

Long-term NO_X modeling indicated the currently projected mine activities will be in compliance with the annual NO_X AAQS for the life of the Belle Ayr Mine. For year 2008, the maximum annual NO_X concentration along the Belle Ayr LNCM boundary was 38.5 $\mu g/m^3$ and for year 2013, the maximum annual NO_X concentration along the Belle Ayr LNCM boundary was 38.0 $\mu g/m^3$ (FCW 2006). Coal production in both years was assumed to be the maximum permitted production level of 45 million tons. The locations of the maximum-modeled NO_X concentrations along the Belle Ayr LNCM boundary for 2008 and 2013 are shown on figures 3-8 and 3-9, respectively. The potential NO_X impacts from mining the Belle Ayr North LBA tract have been inferred to be similar to the currently permitted impacts of mining the existing coal leases at the Belle Ayr Mine because of the similarities in mining rates and mining operations.

<u>3.4.3.1.1.2 West Coal Creek LBA Tract</u>

As discussed in section 3.4.2.2, WDEQ/AQD issued the most recent air quality permit (MD-5393) for the Coal Creek Mine on September 2, 2008, and the mine was required to conduct NO_2 dispersion modeling in their permit. Geomatrix Consultants, Inc. reviewed regulatory modeling techniques to select the most appropriate air quality dispersion model to simulate dispersion of air pollutants emitted by the proposed project for a near-field AQIA. Following WDEQ guidance, the ISCLT3 was used in all modeling analyses. Emission rates were determined for the same worst-case years used in the PM_{10} modeling. NO_X modeling closely followed many of the same procedures used in the PM_{10} analysis. Emissions were apportioned in a similar manner and the same meteorological data set was used. Area source, haul road, and point source information for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines and information for railroads, roads, power plants, and regional sources provided by WDEQ/AQD were included in the model. The amount of NO_X emissions from blasting is related to the amount of ANFO utilized. NO_X emission rates for 2009 and 2016 are expected to be 1,033 tpy and 1,493 tpy, respectively.

Long-term NO_X modeling indicated the currently projected mine activities will be in compliance with the annual NO_X AAQS for the life of the Coal Creek Mine. For year 2009, the maximum annual NO_X concentration along the Coal Creek LNCM boundary was 47.68 μg/m³ and for year 2016, the maximum annual NO_X concentration along the Coal Creek LNCM boundary was 47.81 μg/m³ (WDEQ/AQD 2008b). Coal production in both years was assumed to be the maximum permitted production level of 50 million tons. The locations of the maximum-modeled NO_X concentrations for 2009 and 2016 are shown on figures 3-11 and 3-12, respectively. The potential NO_X impacts from mining the Caballo West LBA tract have been inferred to be similar to the currently permitted impacts of mining the existing coal leases at the Coal Creek Mine because of the similarities in mining rates and mining operations.

3.4.3.1.1.3 Caballo West LBA Tract

WDEQ/LQD investigated the two complaints of off-site NO_X clouds resulting from cast blasting at the Caballo Mine, and as a result WDEQ met with mine officials regarding the complaints. The mine instituted voluntary measures to eliminate NO_X production, including the use of different blasting agents, different blends of blasting agents, different additives, different initiation systems and sequencing, borehole liners, and smaller cast blasts. There have been no subsequent reports of off-site NO_X clouds, to date. As discussed in section 3.4.2.2, WDEQ/AQD issued the most recent air quality permit (MD-1477) for the Caballo Mine on November 7, 2006, and the mine was required to conduct NO_2 dispersion modeling in their permit. McVehil-Monnett Associates, Inc. reviewed regulatory modeling techniques to select the most appropriate air quality dispersion model to simulate dispersion of air pollutants emitted by the proposed project for a near-field AQIA. Following WDEQ guidance, the ISCLT3 was used in all modeling analyses. Emission rates were determined for the same worst-case years used in the PM_{10} modeling. Emissions were apportioned in a similar manner and the same meteorological data set was used. Area source, haul road, and point source information for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines and information for railroads, roads, power plants, and regional sources provided by WDEQ/AQD were included in the model. The amount of NO_X emissions from blasting is related to the amount of ANFO utilized. NO_X emission rates for 2008 and 2014 are expected to be 1,597 tpy and 1,830 tpy, respectively. NO_X modeling closely followed many of the same procedures used in the PM_{10} analysis.

Long-term NO_X modeling indicated the currently projected mine activities will be in compliance with the annual NO_X AAQS for the life of the Caballo Mine. For year 2008, the maximum annual NO_X concentration along the Caballo LNCM boundary was 46.7 μg/m³ and for year 2014, the maximum annual NO_X concentration along the Caballo LNCM boundary was 59.8 μg/m³ (CCC 2006). Coal production in both years was assumed to be the maximum permitted production level of 50 million tons. The locations of the maximum-modeled NO_X concentrations for 2008 and 2014 are shown on figures 3-14 and 3-15, respectively. The potential NO_X

impacts from mining the Caballo West LBA tract have been inferred to be similar to the currently permitted impacts of mining the existing coal leases at the Caballo Mine because of the similarities in mining rates and mining operations.

3.4.3.1.1.4 Maysdorf II LBA Tract

As discussed in section 3.4.2.2, WDEQ/AQD issued the most recent air quality permit (MD-1058) for the Cordero Rojo Mine on September 17, 2004, and the mine was required to conduct NO_2 dispersion modeling in their permit. McVehil-Monnett Associates, Inc. reviewed regulatory modeling techniques to select the most appropriate air quality dispersion model to simulate dispersion of air pollutants emitted by the proposed project for a near-field AQIA. Following WDEQ guidance, the ISCLT3 was used in all modeling analyses. Emission rates were determined for the same worst-case years used in the PM_{10} modeling. NO_X modeling closely followed many of the same procedures used in the PM_{10} analysis. Emissions were apportioned in a similar manner and the same meteorological data set was used. Only the Cordero Rojo Mine was modeled, regional activity was not considered. No NO_X point sources exist at the mine. Additional area sources and line sources were added to describe the railroad tracks/loops on the Cordero Rojo Mine site. The amount of NO_X emissions from blasting is related to the amount of ANFO utilized. NO_X emission rates for 2005 and 2007 are expected to be 2,708 tpy and 3,022 tpy, respectively.

Long-term NO_X modeling indicated the currently projected mine activities will be in compliance with the annual NO_X AAQS for the life of the Cordero Rojo Mine. For year 2005, the maximum annual NO_X concentration along the Cordero Rojo LNCM boundary was 50.3 $\mu g/m^3$ and for year 2007, the maximum annual NO_X concentration along the Cordero Rojo LNCM boundary was 49.6 $\mu g/m^3$ (CMC 1999). Coal production in both years was assumed to be the maximum permitted production level of 65 million tons. The locations of the maximum-modeled NO_X concentrations for 2005 and 2007 are shown on figures 3-17 and 3-18, respectively. The potential NO_X impacts from mining the Maysdorf II LBA tract have been inferred to be similar to the currently permitted impacts of mining the existing coal leases at the Cordero Rojo Mine because of the similarities in mining rates and mining operations.

3.4.3.2 Environmental Consequences Related to Short-Term NO_X Emissions

There are various compounds and derivatives in the family of nitrogen oxides, including NO_2, nitric acid, nitrous oxide, nitrates, and nitric oxide, which may cause a wide variety of health and environmental impacts. According to EPA, the main causes of concern with respect to NO_X are:

- it is one of the main ingredients involved in the formation of ground level ozone, which can trigger serious respiratory problems;

- it reacts to form nitrate particles, acid aerosols, as well as NO_2, which also cause respiratory problems;
- it contributes to the formation of acid rain;
- it contributes to nutrient overload that deteriorates water quality;
- it contributes to atmospheric particles that cause visibility impairment, most noticeably in national parks;
- it reacts to form toxic chemicals;
- one member of the NO_X family, nitrous oxide or N_2O, is a greenhouse gas that contributes to global warming; and
- it can be transported over long distances (EPA 2009b).

Potential health risks associated with inhalation of ground level O_3 and NO_X related particles include acute respiratory problems, aggravated asthma, decreases in lung capacity in some healthy adults, inflammation of lung tissue, respiratory-related hospital admissions and emergency room visits, and increased susceptibility to respiratory illnesses, including bronchitis and pneumonia (EPA 2007b).

Neither the EPA nor the WDEQ have established NAAQS for NO_2 for averaging times shorter than one year. According to EPA, "...the exact concentrations at which NO_2 will cause various health effects cannot be predicted with complete accuracy because the effects are a function of air concentration and time of exposure, and precise measurements have not been made in association with human toxicity. The information that is available from human exposures also suggests that there is some variation in individual response" (EPA 2001a).

While extensive expert testimony was provided to the Wyoming Environmental Quality Council (EQC) during hearings in 2002 arguing for the establishment of a de facto "standard" ranging from 0.5 to 5.0 ppm for a 10-minute exposure, the EQC determined there was insufficient evidence to establish a short-term exposure limit and concluded additional study was required. The primary control measure for mitigating exposures to offsite residences is to avoid blasting when wind direction or atmospheric conditions are unfavorable. Such approaches are employed at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines and will be continued to be employed. Studies that have been conducted to evaluate NO_2 exposures from blast clouds in the PRB are described in appendix H.

Although there is no NAAQS that regulates short-term NO_2 levels, there is concern about the potential health risk associated with short-term exposure to NO_2 from blasting emissions. The National Institute of Occupational Safety and Health

(NIOSH), Occupational Safety and Health Administration (OSHA), and EPA have identified the following short-term exposure criteria for NO_2:

- NIOSH's recommended Immediately Dangerous to Life and Health level is 20.0 ppm (37,600 μg/m³);

- EPA's Significant Harm Level, a 1-hour average, is 2.0 ppm (3,760 μg/m³);

- OSHA's Short-Term Exposure Limit, a 15-minute time-weighted average, which was developed for workers, is 5.0 ppm (9,400 μg/m³), which must not be exceeded during any part of the workday, as measured instantaneously);

- NIOSH's recommendation for workers is a limit of 1.0 ppm (1,880 μg/m³) based on a 15-minute exposure that should not be exceeded at any time during the workday; and

- EPA recommends that concentrations not exceed 0.5 ppm (940 μg/m³) for a 10-minute exposure to protect sensitive members of the public (EPA 2003a).

Through a cooperative agreement between AQD and the Wyoming Mining Association, the Powder River Basin NO_x network began operation in January 2001 (WDEQ/AQD 2008c). The purpose of the monitoring network is to conduct a comprehensive, multi-year monitoring and modeling study of NO_2 exposures from blast clouds. The Black Thunder Mine also conducted a study designed to provide information on safe setback distances for blasting activities at that mine (TBCC 2002). Results of the study (TBCC 2002), conducted pursuant to protocols reviewed and approved by the WDEQ, were provided to the WDEQ and the public in July 2002.

Blast clouds are of a short-term, transient nature. While disagreement still exists regarding acceptable exposure levels, a large amount of actual data are now available from which informed decisions can be made regarding blasting practices. The data show clearly that reduction in blast (agent) size and increases in setback distances are effective methods for mitigating the frequency and extent of public exposure to blasting clouds. See appendix H for additional information about studies that were conducted to evaluate the levels of public exposure to NO_x.

3.4.3.2.1 Proposed Action and Alternatives 2 and 3

Potential NO_X emissions related to mining operations at the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines are described below. Because of the similarities in mining rates and mining operations, the potential impacts of mining the LBA tracts have been inferred from the projected impacts of mining the existing coal leases as currently permitted.

WDEQ/AQD has determined that an assessment of annual NO_X impacts must be included as part of an air quality permitting analysis for new surface coal mines and existing mine plans revisions. Pursuant to WDEQ/AQD requirements, emissions from all stationary engines and natural-gas fired heaters, which are considered to be NO_X point sources at the mine, were considered in the inventory. The regional background NO_X annual concentration used was 20 $\mu g/m^3$. Additional mobile sources were added to describe the railroad locomotives and large mining equipment on each mine site.

The average overburden thickness is generally greater in the LBA tracts than within the current leases, but the thickness of the coal is about the same as in the existing mine areas (tables 3-1 through 3-4). If the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines acquire the LBA tracts, there are no plans to change blasting procedures or blast sizes associated with the mining of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts. However, if the average annual rates of production are maintained, there would potentially be an increase in the frequency of blasting in order to remove the additional volume of overburden overlying the coal.

If the applicant mines acquire the LBA tracts, current mining techniques for removing coal and overburden would be expected to continue for a longer period of time than is shown in the currently approved air quality permits. Modeling for the current Caballo, Belle Ayr, Cordero Rojo, and Coal Creek Mine permits projected no exceedances of the annual NO_X NAAQS at the permitted production rates. Therefore, air quality impacts that result from mining the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II LBA tracts by the applicants at their present production rates should also be within annual NAAQS limits. According to WDEQ, permit conditions designed to control or limit public exposure to NO_2 and flyrock from blasting operations would be no less stringent for mining operations on the LBA tracts than the permit conditions that are in place for blasting operations on the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine leases (Emme 2007).

3.4.3.2.1.1 Belle Ayr North LBA Tract

There have been no reported events of public exposure to NO_2 from blasting activities at the Belle Ayr Mine through December 2008 (Emme 2009). The mine has, however, employed measures to control/limit public exposure to intermittent, short-term (blasting) releases as discussed in section 3.4.3.3. Public exposure to emissions caused by surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. There are occupied dwellings located approximately 0.75 mile north of the LBA tract, and three school bus stops are located on the Bishop Road, one within the LBA tract (figure 3-10).

3.4.3.2.1.2 West Coal Creek LBA Tract

There have been no reported events of public exposure to NO_2 from blasting activities at the Coal Creek Mine through December 2008 (Emme 2009). The mine has, however, employed measures to control/limit public exposure to intermittent, short-term (blasting) releases as discussed in section 3.4.3.3. Public exposure to emissions caused by surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. There are occupied dwellings located approximately 0.2 mile and 1 mile west of the LBA tract, and two school bus stops are located on the Hoadley Road, approximately 1 mile west of the LBA tract (figure 3-13).

3.4.3.2.1.3 Caballo West LBA Tract

There have been no reported events of public exposure to NO_2 from blasting activities at the Caballo Mine through December 2008 (Emme 2009). There were two reports of off-site NO_X clouds related to cast blasts at the Caballo Mine prior to September 2007 but no actual exposure complaints were reported. The mine has employed measures to control/limit public exposure to intermittent, short-term (blasting) releases as discussed in section 3.4.3.3. Public exposure to emissions caused by surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. There are occupied dwellings located approximately 0.6 mile west of the LBA tract, and three school bus stops are located along the Bishop Road, adjacent to the LBA tract (figure 3-16).

3.4.3.2.1.4 Maysdorf II LBA Tract

There have been no reported events of public exposure to NO_2 from blasting activities at the Cordero Rojo Mine through December 2008 (Emme 2009). The mine has, however, employed measures to control/limit public exposure to intermittent, short-term (blasting) releases as discussed in section 3.4.3.3. Public exposure to emissions caused by surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. There are occupied dwellings located approximately 0.4 mile south of the northern portion of the LBA tract and over 0.5 mile east of the LBA tract, and a school bus stop is located along the Hoadley Road, approximately 1.25 miles south of the LBA tract (figure 3-19).

3.4.3.2.2 No Action Alternative

Under the No Action alternative, the coal lease applications would be rejected and the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines would continue to

operate as currently permitted. A discussion of the currently permitted mining operations and potential impacts related to NO_X emissions is included in section 3.4.3.2.1, above. Impacts related to mining operations at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines would continue on the existing mine areas as permitted, but mining operations would not be extended onto those portions of the LBA tracts that will not be affected under the current mining and reclamation plans.

As discussed in chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.4.3.3 Regulatory Compliance, Mitigation, and Monitoring for NO_X Emissions

To date, there have been no reported events of public exposure to NO_2 from blasting activities at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines (Emme 2009). There were two reports of off-site NO_X clouds related to cast blasts at the Caballo Mine prior to September 2007 but no actual exposure complaints were reported. The WDEQ has not required the mines to implement any specific measures to control or limit public exposure to NO_2 from blasting, although mines have voluntarily committed to control blasting emissions. After WDEQ received reports of public exposure to NO_2 from blasting operations at some of the PRB mines prior to September 2007, measures to prevent future such incidences were instituted at those mines when large overburden blasts are planned.

The Wyoming EQC has issued site-specific orders that address procedures and notification protocols related to providing protections from overburden blasting within PRB mine area. The conditions stated that the specific procedures would be used when overburden blasting occurs within a certain distance residences and businesses adjacent to the mines. Orders have also placed limits of the size of the blasting that can be conducted within the mine areas and restricted blasting in the under certain atmospheric conditions.

WDEQ/AQD has the authority revisit air quality issues and to impose site-specific restrictions on blasting/mining operations to control or limit public exposure to NO_2 from blasting if elevated concentrations of NO_2 are recorded and/or exposure to NO_2 becomes a significant problem.

WDEQ has required several mines, including North Antelope Rochelle, Black Thunder, Belle Ayr, Eagle Butte, and Wyodak (figure 1-1), to stop traffic on public roads during blasting due to concerns with fly rock and the "startle factor". Public access to some of the roads in the area, including the Haight, Hilight, and T-7 Roads, are currently blocked and will continue to be blocked during blasting operations when wind directions or proximity to the road warrant such closure.

Mine operators in the eastern PRB have also been working with blasting agent manufacturers to reduce NO_X emissions. Efforts to eliminate NO_X production have included use of different blasting agents, different blends of blasting agents, different additives, different initiation systems and sequencing, borehole liners, and smaller cast blasts. Operators have tried adding substances like microspheres and rice hulls, using different blends of ANFO and slurries and gels, using electronic detonation systems that can vary shot timing, different shot hole patterns, and using plastic liners within the shot holes. No one single procedure or variation has proven consistently successful due to the numerous factors that are believed to contribute to the production of NO_2. The most successful control measure has been reducing the size of the cast blasting shots (Emme 2003, Chancellor 2003). Using the techniques described above, several mines within the PRB have significantly reduced NO_X production (Chancellor 2003).

Mitigation measures will emphasize minimizing exposure to NO_X to all areas adjacent to the mines, including areas near bus stops and residences near the mining areas. As discussed in section 3.4.3.2, the primary control measure employed at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines for mitigating exposure of offsite residences to NO_2 is to avoid shooting cast blasts when wind direction or atmospheric conditions are unfavorable.

Other voluntary measures that limit NO_2 exposure that have been instituted at various PRB mines, particularly when large blasts are planned include:

- telephone notification of neighbors (both private parties and other mining operations) in the general area of the mine prior to large blasts;
- minimizing blast size to the extent possible;
- closing public roads that enter the general mine area, depending on wind conditions and blast location with respect to the road; and
- providing post-blast notification to neighbors of potential exposure to the blasting cloud.

Mitigation measures implemented to reduce mine related NO_X emissions should also reduce the potential for the formation of ground level O_3 in the PRB.

3.4.4 Air Quality Related Values (AQRVs)

AQRVs are evaluated by the land management agency responsible for a Class I area, according to the agency's level of acceptable change (LAC). These AQRVs include potential air pollutant effects on visibility and the acidification of lakes and streams. The AQRVs, and the associated LAC, are applied to PSD Class I and sensitive Class II areas and are the land management agency's policy and are not legally enforceable as a standard.

3.4.4.1 Visibility

Visibility refers to the clarity with which scenic vistas and landscape features are perceived at great distances. Visibility can be defined as the distance one can see and the ability to perceive color, contrast, and detail. Fine particulate matter ($PM_{2.5}$) is the main cause of visibility impairment. Visual range, one of several ways to express visibility, is the furthest distance a person can see a landscape feature. Without the effects of human-caused air pollution, a natural visual range is estimated to be about 140 miles in the western U.S. and 90 miles in the eastern U.S. (EPA 2001b).

Visibility is also expressed in terms of deciview (dv). The dv index was developed as a linear perceived visual change (Pitchford and Malm 1994), and is the unit of measure used in the EPA's Regional Haze Rule to achieve the National Visibility Goal. The National Visibility Goal was established as part of the CAA in order to prevent any future, and remedy any existing, impairment of visibility in mandatory Federal Class I areas that result from manmade air pollution. The deciview index is a scale related to visual perception that has a value near zero for a pristine atmosphere. A change in visibility of 1.0 dv represents a "just noticeable change" by an average person under most circumstances. Increasing dv values represent proportionately larger perceived visibility impairment.

3.4.4.1.1 Affected Environment for Visibility

AQRVs, including the potential air pollutant effects on visibility, are applied to PSD Class I and Class II areas. The land management agency responsible for the Class I area sets an LAC for each AQRV. The AQRVs reflect the land management agency's policy and are not legally enforceable standards. Table 3-10 shows the distances from 31 PSD Class I and Class II areas in the vicinity of the PRB to the general South Gillette analysis area.

The *Wyoming State Implementation Plan for Class I Visibility Protection* states: "Wyoming's long term strategy will focus on the prevention of any future visibility impairment in Class I areas that can be attributed to a source or small group of sources as the Federal Land Managers have not identified any current impairment in the State's Class I areas due to such sources" (WDEQ/AQD 2005a). WDEQ/AQD prepared the *2003 Review Report on Wyoming's Long Term Strategy for Visibility Protection in Class I Areas*, as required by WAQSR, which calls for AQD to review and revise, if appropriate, the Long Term Strategy every 3 years. The 2003 Review Report is available on the WDEQ/AQD website at <http://deq.state.wy.us/aqd/visibility.asp>.

The Regional Haze Rule calls for improved visibility on the most-impaired days and no additional impairment on the least-impaired days. EPA participates in the Interagency Management of protected Visual Environments (IMPROVE) visibility monitoring program as part of its visibility protection program. The IMPROVE

Table 3-10. Approximate Distances and Directions from the General South Gillette Analysis Area to PSD Class I and Class II Sensitive Receptor Areas.

Receptor Area	Distance (miles)	Direction to Receptor
Mandatory Federal PSD Class I Area		
Badlands Wilderness Area[1]	147	E
Bridger Wilderness Area	206	WSW
Fitzpatrick Wilderness Area	208	WSW
Gates of the Mountain Wilderness Area	364	NW
Grand Teton National Park	256	W
North Absaroka Wilderness Area	202	WNW
Red Rocks Lake Wilderness Area	312	W
Scapegoat Wilderness Area	408	WNW
Teton Wilderness Area	215	W
Theodore Roosevelt National Park (North Unit)	266	NNE
Theodore Roosevelt National Park (South Unit)	218	NNE
U.L. Bend Wilderness Area	264	NNW
Washakie Wilderness Area	183	W
Wind Cave National Park	98	ESE
Yellowstone National Park	224	WNW
Tribal Federal PSD Class I		
Fort Peck Indian Reservation	275	N
Northern Cheyenne Indian Reservation	108	NNW
Federal PSD Class II		
Absaroka-Beartooth Wilderness Area	210	WNW
Agate Fossil Beds National Monument	137	SE
Badlands National Park	127	ESE
Bighorn Canyon National Recreation Area	150	WNW
Black Elk Wilderness Area	91	E
Cloud Peak Wilderness Area	81	W
Crow Indian Reservation	103	NW
Devils Tower National Monument	50	NE
Fort Belknap Indian Reservation	302	NNW
Fort Laramie National Historic Site	134	SSE
Jewel Cave National Monument	80	ESE
Mount Rushmore National Memorial	96	E
Popo Agie Wilderness Area	201	WSW
Soldier Creek Wilderness Area	126	SE

[1] The U.S. Congress designated the Wilderness Area portion of Badlands National Park as a mandatory Federal PSD Class I area. The remainder of Badlands National Park is a PSD Class II area.

monitoring sites were established to be representative of all Class I areas. On December 20, 2005, the IMPROVE Steering Committee approved a new algorithm for calculating current and natural background visibility. Figure 3-20 shows annual averages, based on the new algorithm, for the 20 percent best, average, and worst visibility days at Badlands National Park in South Dakota and Bridger Wilderness Area in Wyoming from 1989 through 2005 (IMPROVE 2007). To date, Badlands National Park has shown a trend toward improved visibility on the least, average, and most-impaired days. Bridger Wilderness has shown a trend toward improved visibility on the average and least-impaired days and no change in visibility on the most-impaired days.

3.4.4.1.2 Environmental Consequences for Visibility

3.4.4.1.2.1 Proposed Action and Alternatives 2 and 3

The impacts to visibility from mining the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts have been inferred from the currently permitted impacts of mining the existing coal leases at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines, respectively. If the mines acquire the additional coal in the LBA tracts, the LBA tracts would be mined as an integral part of the applicant mines. The average annual coal production for each mine is anticipated to remain at the projected post-2007 rates, with or without the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts. Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines coal production and currently approved air quality permitted tons are shown in tables 2-1 through 2-4, respectively. If the mines acquire the additional coal in the LBA tracts, they would continue to produce at existing rates for a longer period of time (2 to 10 years). Therefore, impacts to visibility under the Proposed Action and Alternative 2 (Alternative 3 for the Maysdorf II Tract), BLM's preferred alternatives, would be similar to the impacts under the No Action alternative, except they would be extended by 2.2 years (for the Caballo West LBA tract as applied for) up to as many as 10.0 years (for the Maysdorf II LBA tract under Alternative 3).

Current techniques for blasting, coal removal, and coal processing would be expected to continue for a longer period of time than is shown in the applicant mines' currently approved air quality permits. Material movement would continue to utilize direct cast blasting, draglines, and/or truck and shovel fleets for overburden and truck and shovel fleets and overland conveyors for coal. The applicant mines would not propose significant changes to the facilities shown in the current air quality permits or the blasting procedures or blast sizes if they acquire the tracts. However, the blasting processes and required mitigation measures would be reviewed when the mining permits are amended to include the new lease areas, and the blasting plans would be modified to incorporate the BACT protection measures that are in effect at that time. Overburden is generally thicker in the LBA tracts than the current lease areas; therefore, state of the art methods to minimize any increases in blast sizes and/or blasting agents will be

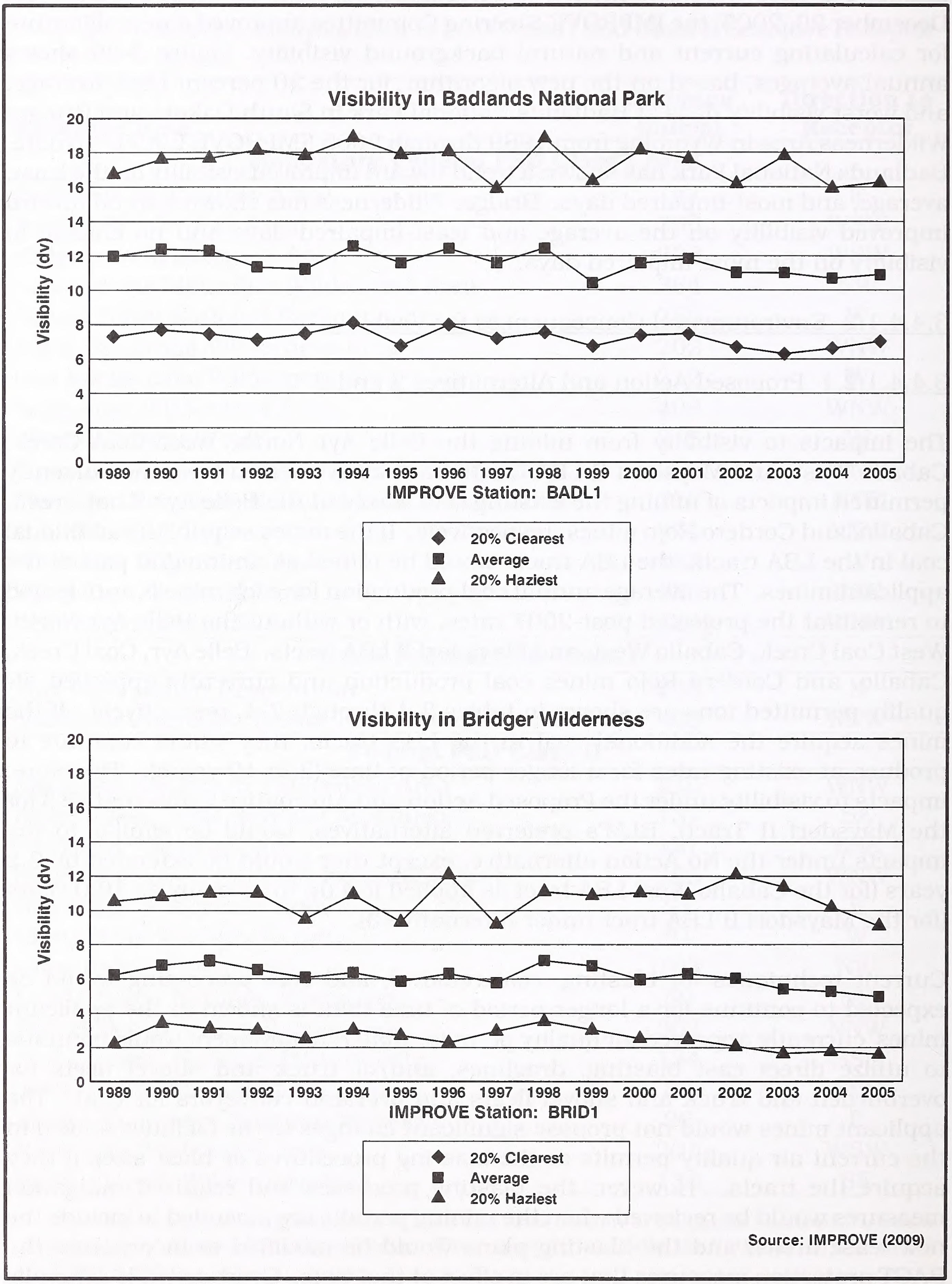


Figure 3-20. Visibility in the Badlands and Bridger Wilderness Areas.

employed. Thus, emissions from blasting are not expected to increase significantly, notwithstanding the increased thicknesses of overburden that would be excavated in these LBA tracts.

Surface coal mines are not considered to be major emitting facilities in accordance with Chapter 6, Section 4 of WDEQ/AQD Rules and Regulations. Therefore, the state of Wyoming does not require mines to evaluate their impacts on Class I areas; however, BLM considers such issues during leasing.

3.4.4.1.2.2 No Action Alternative

Under the No Action alternative, the coal lease applications would be rejected and the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines would continue to operate as currently permitted for about 8, 16, 15, and 11 more years, respectively. Coal removal would not occur on the LBA tracts. Impacts to visibility related to mining operations at the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines would not be extended onto those portions of the LBA tracts that will not be affected under the current mining and reclamation plans.

As discussed in section 2.2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications at this time would not preclude an application to lease the tracts in the future.

3.4.4.1.3 Regulatory Compliance, Mitigation and Monitoring for Visibility Impacts

As discussed above, fine particulate matter ($PM_{2.5}$) is the main cause of visibility impairment. Mitigation measures being used to limit emissions of particulate matter are discussed in section 3.4.2.3.

Visibility monitoring within the state of Wyoming consists of both the WDEQ/AQD sponsored Wyoming Visibility Monitoring Network and the IMPROVE program. WDEQ has sited two visibility monitoring stations in the PRB. One of these sites (the Thunder Basin National Grasslands site) is 32 miles north of Gillette and includes a nephelometer, a transmissometer, an IMPROVE aerosol sampler, instruments to measure meteorological parameters (temperature, RH, wind speed, wind direction), a digital camera, instruments to measure O_3, and instruments to measure oxides of nitrogen (NO, NO_2, NO_X). The second visibility monitoring station (the Cloud Peak Wilderness Area site) is located 14 miles west of Buffalo and includes a nephelometer, a transmissometer, an IMPROVE aerosol sampler, instruments to measure meteorological parameters, and a digital camera.

These sites are being utilized to characterize the extent, frequency of occurrence, and magnitude of visual air quality impacts. The IMPROVE Steering Committee approved the incorporation of the Thunder Basin and Cloud Peak sites into the IMPROVE network in June 2002. Although these stations are not located in areas

classified as Class I areas, the collected data will be comparable to monitoring data available from the state's Class I areas. This information can help scientists determine the types and concentrations of air pollutants and their direction of travel in order to project visibility impacts to Class I areas. The Wyoming Visibility Monitoring Network was recently supplemented with the development of a website (http://www.wyvisnet.com/all.html) to allow public access to real-time monitored visibility and air quality conditions (WDEQ/AQD 2005b).

3.4.4.2 Acidification of Lakes

The acidification of lakes and streams is caused by atmospheric deposition of pollutants (acid rain). According to EPA, SO_2 and NO_X, primarily derived from the burning of fossil fuels, are the primary causes of acid rain (EPA 2009c). Most lakes and streams have a pH between 6 and 8, although some lakes are naturally acidic even without the effects of acid rain. Acid rain primarily affects sensitive bodies of water, which are located in watersheds whose soils have a limited ability to neutralize acidic compounds (called "buffering capacity"). Lakes and streams become acidic (pH value goes below a value of 7[on a scale of 1 to 14]) when the water itself and its surrounding soil cannot buffer the acid rain enough to neutralize it. In areas where buffering capacity is low, acid rain also releases aluminum from soils into lakes and streams; aluminum is highly toxic to many species of aquatic organisms.

Several regions in the U.S. were identified in a national surface water survey as containing many of the surface waters sensitive to acidification. They include the Adirondacks and Catskill Mountains in New York State, the mid-Appalachian highlands along the east coast, the upper Midwest, and mountainous areas of the western U.S.

Scientists predict that the decrease in SO_2 emissions required by the Acid Rain Program will significantly reduce acidification due to atmospheric sulfur. Without the reductions in SO_2 emissions, the proportions of acidic aquatic ecosystems would remain high or dramatically worsen (EPA 2005a). The U.S. Department of Agriculture – Forest Service (USFS) has been monitoring air quality in the Wind River Mountain Range in Wyoming since 1984 and is seeing a general trend of decreasing sulfates. Nitrates, on the other hand, have been increasing globally.

3.4.4.2.1 Affected Environment

AQRVs, including the potential air pollutant effects on the acidification of lakes and streams, are applied to PSD Class I and Class II areas. The land management agency responsible for the Class I area sets a LAC for each AQRV. The AQRVs reflect the land management agency's policy and are not legally enforceable standards. Lake acidification is expressed as the change in ANC measured in microequivalents per liter (μeq/L), the lake's capacity to resist acidification from acid rain. Table 3-11 shows the existing ANC monitored in some mountain lakes

Table 3-11. Existing Acid Neutralizing Capacity in Sensitive Lakes.

Wilderness Area	Lake	Background ANC (μeq/L)	Distance from General South Gillette Analysis Area (miles)
Bridger	Black Joe	69.0	240
	Deep	61.0	230
	Hobbs	68.0	245
	Upper Frozen	5.8[1]	250
Cloud Peak	Emerald	55.3	105
	Florence	32.7	95
Fitzpatrick	Ross	61.4	240
Popo Agie	Lower Saddlebag	55.5	230

[1] The background ANC is based on only six samples taken between 1997 and 2001.
Source: Argonne (2002)

and their distance from the general South Gillette analysis area. The USFS considers lakes with ANC values between 25 and 100 microequivalents per liter (μeq/l) to be very sensitive to atmospheric deposition and lakes with ANC values less than or equal to 25 μeq/l to be extremely sensitive to atmospheric deposition.

3.4.4.2.2 Environmental Consequences

3.4.4.2.2.1 Proposed Action and Alternatives 2 and 3

The Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tract would be mined as an integral part of the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines, respectively; therefore, the impacts to air quality from mining the LBA tracts have been inferred from the impacts at the currently permitted mining operations. The applicant mines anticipate that coal production would remain unchanged from projected post-2007 levels if the LBA tracts are acquired.

The applicant mines anticipate that coal production would remain unchanged from the projected post-2008 levels if the LBA tracts are acquired. Impacts to air quality related to lake acidification under the Proposed Action and Alternative 2 (Alternative 3 for the Maysdorf II Tract), BLM's preferred alternatives, would therefore be similar to the impacts under the No Action alternative, except they would be extended by 2.2 years (for the Caballo West LBA tract as applied for) up to as many as 10.0 years (for the Maysdorf II LBA tract under Alternative 3).

The Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines would employ the best measures available to mitigate any potential emission increases associated with mining the LBA tracts. These would include, but would not necessarily be limited to, extension of overland conveyors to minimize haul distances and associated particulate and gaseous (i.e., nitrogen oxides, carbon oxides and sulfur dioxides) emissions from coal haulage, as well as state-of-the-art blasting practices to

mitigate any potential increases in nitrogen oxide emissions, which can also contribute to acidification.

3.4.4.2.2.2 No Action Alternative

Under the No Action alternative, the coal lease applications would be rejected and the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines would continue to operate as currently permitted for about 8, 16, 15, and 11 more years, respectively. Coal removal would not occur on the LBA tracts. Lake acidification impacts related to mining operations at the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines would not be extended onto those portions of the LBA tracts that will not be affected under the current mining and reclamation plans.

As discussed in chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications at this time would not preclude an application to lease the tracts in the future.

3.4.4.2.3 Regulatory Compliance, Mitigation, and Monitoring

Mitigation and monitoring for coal mine emissions, including the emissions that contribute to the acidification of lakes, are discussed in sections 3.4.2.3, 3.4.2.4., 3.4.3.3, and 3.4.3.4. Other air quality monitoring programs that are in place in the PRB include Wyoming Air Resources Monitoring System (WARMS) monitoring of sulfur and nitrogen concentrations near Buffalo, Sheridan, and Newcastle, and the National Atmospheric Deposition Program (NADP) monitoring of precipitation chemistry in Newcastle.

3.4.5 Residual Impacts to Air Quality

No residual impacts to air quality would occur following mining and reclamation.

3.5 Water Resources

3.5.1 Groundwater

3.5.1.1 Affected Environment

The general South Gillette analysis area contains three water-bearing geologic units that have been directly affected by existing mining activities and would be directly affected by mining the four LBA tracts. In descending order, these units are the recent alluvium, the Wasatch Formation overburden, and the mineable coal seam in the Tongue River Member of the Fort Union Formation, referred to as the Wyodak or Wyodak-Anderson. The underlying, sub-coal Fort Union Formation, the Lance Formation, and the Fox Hills Sandstone are used for water supply at the four coal mines within the general South Gillette analysis area, but

these units are not physically disturbed by mining activities. Both regional and site-specific baseline hydrogeologic environments within and around the general analysis area are extensively characterized in the WDEQ/LQD mining and reclamation permits for the four applicant mines included in this analysis (CCC 2003, FCW 2003, CMC 2007a, and TBCC 2006). Figure 3-2 presents stratigraphic relationships and hydrologic characteristics of the units underlying the general South Gillette analysis area.

3.5.1.1.1 Recent Alluvium

Within the analysis area, alluvial (unconsolidated stream laid) deposits are present mainly in the valleys of the larger drainages such as the Belle Fourche River, Coal Creek, Caballo Creek, Duck Nest Creek, and Tisdale Creek. Less extensive deposits of alluvium are found along the lower reaches of draws that are tributary to these major streams. Colluvial and playa deposits associated with other minor surface drainages within the general area are very thin and not laterally extensive enough to be considered aquifers.

Within the Belle Ayr North LBA tract, alluvial deposits are associated with Duck Nest Creek, an ephemeral tributary of Caballo Creek. The alluvial deposits consist of intermixed fine-grained sands, silts, and clays. The surficial deposits adjacent to the alluvium consist of fan and sheetwash materials where the terrain is nearly flat. The textures of these deposits are similar, making the outer edge of alluvial deposits difficult to distinguish. Alluvial deposits along Duck Nest Creek vary from 0 to approximately 20 feet thick and are typically around 10 to 15 feet thick. The alluvium's saturated thickness averages about 10 feet, and alluvial groundwater flow is downvalley. Duck Nest Creek alluvium is recharged by streamflow, water in the channel impoundments, and groundwater discharged from a bedrock source underlying the alluvial deposits. The overburden groundwater discharge rate was estimated by FCW to be less than 0.1 acre-feet per year, which is only enough to create a marshy area with some small shallow pools of stagnant water. Patches of thick alkali crust are present around the edges of the pools and on the soil surface in this marshy area, which is referred to as the "saline seeps". The saline seeps were located near the southern edge of the Belle Ayr North LBA tract and were disturbed by mining in 2006 and are no longer present. Groundwater yields measured by FCW at some Duck Nest Creek alluvial monitoring wells are very low, ranging from 0 to 3 gallons per minute (gpm). Aquifer testing indicates that the Duck Nest Creek alluvial aquifer has a very low hydraulic conductivity (ranging from about 0.05 – 0.35 ft/day).

Duck Nest Creek alluvial groundwater quality is highly variable spatially and poor to very poor. In the saline seeps area, total dissolved solids (TDS) concentrations range from roughly 3,800 mg/L to over 51,000 mg/L. The alluvial groundwater type is generally a magnesium or sodium sulfate, with the sulfate concentration averaging over 25,000 mg/L and ranging up to almost 33,000 mg/L. Both TDS and sulfate concentrations are well over the maximum allowed in any

WDEQ/WQD use classification (WDEQ/WQD 2005). Discharge from underlying bedrock (Wasatch Formation overburden) units in the saline seeps area contributes to the poor alluvial water quality. Alluvial groundwater quality upstream of the saline seeps area, within the LBA tract, is somewhat better but still poor and does not meet WDEQ/WQD standards for any use classification. The TDS concentration is generally around 20,000 mg/L to 25,000 mg/L, the sulfate concentration ranges from approximately 12,500 mg/L to over 15,000 mg/L, and the sodium adsorption rate (SAR) values are high, ranging from 17.6 to 19.8.

Within the West Coal Creek LBA tract, alluvial deposits are associated with Coal Creek, an ephemeral tributary of the Belle Fourche River. These unconsolidated stream laid deposits consist of intermixed fine-grained sands, silts, and clays, and range from 10 to 25 feet thick. Saturated thicknesses range from 0 to a maximum of approximately 15 feet at the confluence of East Fork Coal Creek and Middle Fork Coal Creek. Field aquifer tests indicated that the Coal Creek alluvium has a very low hydraulic conductivity, ranging from nearly 0 to 2.35 ft/day. Due to its limited areal extent, limited saturated thickness, and low hydraulic conductivity, Coal Creek alluvium does not consistently produce enough water to be used beneficially. In addition, based on TDS concentrations, Coal Creek alluvial groundwater generally meets the WDEQ/WQD standards for livestock use. However, the quality is variable from well to well and at some locations it may exceed the livestock standard and at other locations it may be suitable for both livestock and agricultural use.

Within the Caballo West LBA tract, alluvial deposits are associated with Tisdale Creek, an ephemeral tributary of Caballo Creek. The Tisdale Creek alluvial deposits are typified by both lateral and vertical heterogeneity and are generally comprised of gravels, coarse- to fine-grained sands, and local lenses of silty, commonly organic-rich clays. Alluvial materials presently being deposited by fluvial processes along Tisdale Creek are clayey and heavy-textured. The thickness of Tisdale Creek alluvial deposits within the LBA tract average approximately 12 feet, and the saturated thickness varies from almost 0 to more than 10 feet, and is greatest near the stream channel. Tisdale Creek alluvial monitor well water levels indicate that alluvial groundwater progresses down-valley under a hydraulic gradient similar to that of the valley profile. Recharge to the alluvium is from direct precipitation, streamflow infiltration, and groundwater contributions from underlying bedrock (Wasatch Formation overburden). The water table geometry near the stream suggests that the stream generally loses water to the alluvium but may gain water depending on the season and extent of saturation in the alluvium. Like the adjacent Duck Nest Creek, Tisdale Creek alluvial groundwater quality is poor, with a mean TDS concentration ranging from approximately 4,900 mg/L to 36,000 mg/L. Due to the high salinity, Tisdale Creek alluvial groundwater is considered unsuitable for domestic and irrigation uses, and is marginal in some areas for livestock and wildlife use. The low hydraulic conductivities and limited areal extent of saturation indicate that the

alluvium does not exhibit aquifer characteristics adequate for producing groundwater in sufficient quantities for agricultural or domestic uses. There is currently no known use of alluvial groundwater in or near the Caballo West LBA tract.

Within the Maysdorf II LBA tract, alluvial deposits are found primarily within the Belle Fourche River valley. The alluvium consists of recent stream channel deposits and topographically higher terrace deposits that predate the recent deposition. The deposits are typified by lateral and vertical heterogeneity and are generally comprised of gravels, coarse- to fine-grained sands, and local lenses of silty, commonly organic-rich clays. The upper-most terrace is comprised predominately of relatively homogeneous sandy silts and clays overlying basal gravel deposits. The alluvial materials presently being deposited by the stream are clayey and heavy-textured. The thickness of Belle Fourche River alluvial deposits varies from absent where bedrock is exposed in the stream channel to more than 40 feet. Saturated alluvium along the river varies from absent (dry from land surface to the top of the underlying Wasatch Formation) to more than 10 feet thick, and is greatest near the stream channel. Field and laboratory aquifer tests indicate that the alluvium has very low productivity and low hydraulic conductivity. Alluvial monitor well water levels recorded by the Cordero Rojo Mine indicate that alluvial groundwater flows down-valley, and exhibits a hydraulic gradient similar to that of the valley profile. Recharge to the alluvium is from direct precipitation, stream flow infiltration, and adjacent upland overburden areas. In general, the groundwater quality in the saturated Belle Fourche River alluvium within the LBA tract is poor, with a TDS concentration averaging around 4,100 milligrams per liter (mg/L) and the water type is characterized as a sodium/calcium-sulfate.

Belle Fourche River alluvial groundwater is considered unsuitable for domestic consumption and irrigation and marginal for livestock and wildlife use because of the high salinity. The alluvial groundwater quality is similar to that of the underlying Wasatch Formation. The low hydraulic conductivities and limited areal extent of saturation indicate that the Belle Fourche River alluvium does not exhibit aquifer characteristics adequate for agricultural or domestic uses. There is currently no known use of alluvial groundwater in or near the tract.

3.5.1.1.2 Wasatch Formation

Within the PRB, the Wasatch Formation (the strata lying above the mineable coal, also called the overburden) consists of various non-marine, fluvial and aeolian deposits of interbedded sands, silts, and clays with occasional discontinuous deposits of coal and carbonaceous material. The Wasatch strata range in cohesion from unconsolidated (i.e., loose sands and silts) to lithified (i.e., sandstones, siltstones, shales, and coal stringers). Any of the deposits may be water bearing, although the sands and sandstones possess a greater, but laterally limited, potential for groundwater yield. These sands are generally discontinuous

and separated laterally and vertically by fine-grained deposits. This basic description generally holds true for all of the general South Gillette analysis area.

The discontinuous nature of the sediments produce considerable variability in the occurrence of groundwater in the overburden both laterally and vertically. The hydraulic connection between water-bearing units is tenuous due to intervening shale aquitards; thus, groundwater movement through the Wasatch Formation overburden is limited. Due to the discontinuous nature of the permeable overburden sediments, premine overburden groundwater movement generally follows the topography. Because the water-bearing units within the Wasatch Formation are not continuous, the formation is not considered to be a regional aquifer. However, Wasatch sands and sandstones do provide limited amounts of groundwater for livestock and domestic uses on a local scale, provided the water quality is suitable. Channel-like deposits of unconsolidated sand (paleochannel sands) with up to about 60 feet of saturation occasionally occur in the Wasatch overburden, and wells developed in these sands may individually yield up to 50 gpm. Paleochannels are typically less than 500 feet wide and are isolated laterally and vertically by silt and clay deposits of very low permeabilities.

Another geologic unit that may be considered a part of the Wasatch Formation is scoria, also called clinker or burn. It consists of sediments that were baked, fused, and melted in place when the underlying coal burned spontaneously. These burned sediments collapsed into the void left by the burned coal. Scoria deposits can be a very permeable aquifer and can extend laterally for miles in the eastern PRB. The occurrence of scoria is site-specific, typically occurring in areas where coal seams crop out at the surface. The scoria provides infiltration of precipitation and recharge to laterally contiguous overburden and coal beds. The West Coal Creek LBA tract is the only tract in the general South Gillette analysis area that contains scoria deposits; however, they are isolated and not extensive or saturated enough to be considered an aquifer or a source of recharge.

Recharge to the Wasatch Formation is from the infiltration of precipitation, surface water stored in playas and in-channel reservoirs, and lateral movement of water from adjacent scoria bodies. Regionally, groundwater is discharged from the formation by evaporation and transpiration, by pumping wells, by draining into mine excavations, and by seeping into the alluvium along stream courses. Overburden groundwater is not generally connected to the underlying Wyodak coal seam due to a low-permeability stratum at the base of the overburden, which is fairly widespread in the general South Gillette analysis area. However, some leakage between the aquifers provides vertical recharge to the coal aquifer.

For the Wasatch Formation as a whole in the PRB, the discontinuous nature of the water bearing units results in low overall hydraulic conductivity and low groundwater flow rates. Because of the varied nature of the aquifer units within the Wasatch, hydraulic properties vary as well. Martin et al. (1988) reported that hydraulic conductivities within the Wasatch ranged from 10^{-4} ft/day to 10^{2} ft/day,

and the geometric mean hydraulic conductivity based on 203 tests was 0.2 ft/day. The geometric mean hydraulic conductivity from 70 aquifer tests using wells completed in sandstone in the Wasatch overburden was 0.35 ft/day, while that from 63 aquifer tests using wells completed in siltstone and claystone in the Wasatch overburden was 0.007 ft/day (Rehm et al. 1980). Field aquifer tests conducted in the general South Gillette analysis area by the four applicant mines indicate that the water-bearing Wasatch overburden strata typically have a low hydraulic conductivity, ranging from 0.004 ft/day to 78.0 ft/day, and verify that the overburden sand bodies are isolated hydraulically from one another.

The quality of groundwater in the Wasatch Formation is extremely variable and generally poor. In the general South Gillette analysis area, TDS concentrations range from 525 mg/L to 13,000 mg/L and the water type is typically a calcium-sulfate, magnesium-sulfate, or a sodium-sulfate. The median TDS for the group of mines located between Gillette and Wright, as calculated by WDEQ/LQD based on 1,109 samples, is 2,996 mg/L (Ogle et al. 2005). Overburden groundwater is generally considered unsuitable for domestic consumption and irrigation use but is suitable for livestock and wildlife use.

3.5.1.1.3 Wyodak/Wyodak-Anderson Coal

The Tongue River Member of the Fort Union Formation contains the mineable coal zone, which is often divided by partings that separate it into two or more units. The mineable coal zones are referred to as the Anderson and Canyon, Roland and Smith, Wyodak-Anderson, Upper and Lower Wyodak, or Wyodak seams. A general discussion of the coal seam aquifer follows.

Due to its continuity, the Wyodak coal seam is considered a regional aquifer because it is water bearing and is laterally continuous throughout the area. Historically, the Fort Union coal seams have been a source of groundwater for domestic and livestock uses in the eastern PRB. However, due to the 1 to 3 degree west-northwest dip of the coal beds, the coal generally becomes too deep to be an economical source of water within a couple of miles west of the PRB surface coal mines.

Hydraulic conductivity within this coal seam is highly variable and reflective of the amount of fracturing the coal has undergone, as unfractured coal is virtually impermeable. Field aquifer tests indicate that the coal has a low to moderate transmissivity with a range of roughly three orders of magnitude. The yield of groundwater to wells and mine pits is smallest where the permeability of the coal is derived primarily from localized unloading fractures. These fractures, which are the most common, are created by the coal expanding of the coal as the weight of overlying sediments is slowly removed by erosion. Localized zones of moderately high transmissivity occur due to increased fracturing, and the highest permeability is imparted to the coal by tectonic fractures. These are through-going fractures of areal importance created during deformation of the Powder River

structural basin. The presence of these fractures can be recognized by their linear expression at the ground surface, controlling the orientation of stream drainages and topographic depressions. Due to their pronounced surface expression, these tectonic fractures are often referred to as "lineaments". Coal permeability along lineaments can be increased by orders of magnitude over that in the coal fractured by unloading only. Such increased aquifer transmissivity occurs west of the Cordero Rojo Mine area and is attributed to structural development that has produced additional fracturing.

Field aquifer tests conducted in the general South Gillette analysis area by the four applicant mines indicate that the coal aquifer is non-homogeneous and generally low in transmissivity with some local areas of high transmissivity. Hydraulic conductivity values reported by the four applicant mines for the Wyodak/Wyodak-Anderson coal seam ranges from 0.008 ft/day to 66.7 ft/day, with means ranging from approximately 4.0 ft/day to 14.0 ft/day. Storage coefficients measured within and around the general South Gillette analysis area range from 10^{-3} to 10^{-4}, indicative of a confined aquifer.

Recharge to the coal occurs principally by infiltration of precipitation in the clinker outcrop areas along the flank of the eastern Powder River structural basin. Secondary vertical recharge from the overburden also occurs, but is highly variable. Prior to mining, the direction of groundwater flow within the areally continuous coal aquifer was generally from recharge areas at the coal seam's outcrop westward into the PRB, following the dip of the coal. Groundwater conditions varied from unconfined to confined, depending on the coal elevation and proximity to the outcrop area. Water levels were generally above the top of the coal away from the outcrop.

Site-specific water-level data collected from coal monitoring wells by mining companies and the BLM in the analysis area and presented in the GAGMO 25-year report (Hydro-Engineering 2007) indicate that the groundwater flow directions in the Wyodak coal have been greatly influenced by surface mine dewatering and groundwater discharge associated with CBNG development. Groundwater levels observed near active mining areas prior to 1997 were likely due to mine dewatering alone. The groundwater flow direction within the coal aquifer was typically toward the mine pits. By 2000, groundwater level decline rates had dramatically increased because drawdown caused by widespread CBNG development west of the mines was overlapping with drawdown caused by mining operations. A continuous cone of depression currently exists around the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines due to their closeness to each other and the cumulative drawdown effects from pit dewatering and nearby CBNG discharges. The extent of drawdown west of the mines that is specifically attributable to mine dewatering can no longer be defined due to much greater and areally extensive drawdown caused by CBNG development. Roughly 30 years of surface mining and the more recent CBNG development has resulted in complete

dewatering of the coal aquifer in localized areas, particularly near the mines' pits and where the coal seams are structurally highest.

Coal groundwater is typically only suitable for livestock and wildlife use because certain constituent concentrations commonly exceed many suitability criteria for domestic uses. Also, the water may have a high salinity and sodium hazard, which makes it unsuitable for agricultural uses. Within the general South Gillette analysis area, Wyodak coal groundwater quality is generally poor, but exhibits lower TDS concentrations than alluvial or overburden groundwater. The composition of groundwater in the coal is fairly uniform and there are no seasonal or long-term trends in composition. The composition of groundwater in the coal is generally characterized as a calcium/magnesium-sulfate type near the scoria outcrop recharge areas and transitions to a sodium-bicarbonate type as the groundwater moves downgradient. In the analysis area, TDS concentrations range from 442 mg/L to 4,400 mg/L, with averages reported by the four applicant mines ranging from approximately 950 mg/L to 1,700 mg/L. This compares to a median TDS of 920 mg/L calculated by the WDEQ/LQD for the Belle Aye Mine and adjacent mines, based on 1,200 samples collected from the coal aquifer (Ogle et al. 2005).

3.5.1.1.4 Subcoal Fort Union Formation

The Fort Union Formation is divided into three members (in descending order): the Tongue River, the Lebo, and the Tullock. The mineable coal seams occur within the Tongue River Member. The subcoal Fort Union Formation consists primarily of lithified sands and shales and is divided into three hydrogeologic units: the upper Tongue River aquifer, the Lebo confining layer, and the Tullock aquifer (Law 1976). Of the three units, the Tullock yields the most groundwater.

Mining does not directly disturb the hydrogeologic units below the mineable coal, but many PRB mines use them for industrial water supply wells. In a few cases there have been drawdowns in the subcoal aquifer due to leakage into mine pits, dewatering, and CBNG development (BLM 2001b). The upper Tongue River aquifer consists of lenticular, fine-grained sandstone interbedded with mudstone. The Lebo confining layer is typically more fine-grained than the other two members and generally retards the movement of water (Lewis and Hotchkiss 1981). The Lebo confining layer typically separates the Tongue River and Tullock aquifers hydraulically. The Tullock aquifer consists of discontinuous lenses of sandstone separated by interbedded shale and siltstone.

Transmissivity is equal to an aquifer's hydraulic conductivity, or permeability, times the aquifer's saturated thickness, and is used when discussing the hydraulic properties of the subcoal Fort Union Formation where wells are completed by exposing many discrete sand lenses to the well bore. Transmissivities are generally higher in the deeper Tullock aquifer than in the shallower Tongue River aquifer, and many mines in the PRB have water-supply

wells completed in this interval (Martin et al. 1988). The city of Gillette also uses the Tullock aquifer to meet part of its municipal water requirements. The average transmissivity for the Tullock, as reported by OSM (1984), is 290 ft^2/day. The four applicant mines use a total of eight wells completed in the subcoal Fort Union Formation for water supply, and they range in depth from approximately 850 feet to 2,487 feet.

The water quality of the subcoal Fort Union Formation is generally good. TDS concentrations measured in various subcoal Fort Union Formation water supply wells in the eastern PRB range from 230 mg/L to 520 mg/L. Water from this formation is typically of the sodium-bicarbonate type. This water is generally suitable for livestock and wildlife watering and may be suitable for domestic use. Depending upon site-specific TDS concentrations and SAR values, groundwater from Fort Union Formation supply wells may also be suitable for irrigation.

3.5.1.1.5 Lance Formation-Fox Hills Sandstone

Underlying the Fort Union Formation is the Lance Formation of Cretaceous age. The Lance Formation is comprised of an upper confining layer and a lower aquifer. Individual sandstone beds of the lower aquifer sequence are up to about 100 feet thick, are fine-grained, and contain variable amounts of interbedded clay and silt. The Fox Hills Sandstone underlies the Lance Formation and is usually difficult to distinguish from the Lance. The Fox Hills is described as well-developed, fine- to medium-grained, marine sandstone that contains thin beds of sandy shale and averages around 250 feet thick beneath the general South Gillette analysis area.

The Caballo and Cordero Rojo mines each have one industrial water supply well completed in the Fox Hills Sandstone, while two industrial water supply wells within Belle Ayr Mine's existing permit area are completed in the Lance/Fox Hills aquifer. These wells are all around 4,000 feet deep. The city of Gillette also uses the Lance/Fox Hills aquifer to meet part of its municipal water requirements, as do the Wyodak Power Plant and various other eastern PRB surface coal mines. Groundwater quality from this aquifer is good enough to meet the standards for domestic use, depending upon the concentrations of TDS and various constituents such as fluoride. Sodium and bicarbonate are typically the predominant ionic constituents.

3.5.1.2 Environmental Consequences

3.5.1.2.1 Proposed Action and Alternatives 2 and 3

Surface coal mining impacts the quantity of the groundwater resource in two ways: 1) the coal aquifer and any aquifers present in the overburden are removed from the mined areas during mining and replaced with unconsolidated backfill after the coal is removed, and 2) water levels in the coal and overburden aquifers

adjacent to the mine pits are depressed as a result of seepage into and dewatering from the open excavations in the area of coal and overburden removal.

If the tracts are leased and mined, the overall regional extent of coal removal and reclamation would increase, along with a potential increase of mining-related impacts to groundwater quantity. As mining expands, additional water-bearing bedrock strata would be exposed and groundwater would drain by gravity into the active pits. The overburden and coal aquifers within the tracts would be completely dewatered and removed, and the area of drawdown caused by overburden and coal removal would be extended further to the west of the active mine areas. However, the amount and extent of additional drawdown may not be great, as current drawdown associated with mining the existing leases combined with drawdown associated with CBNG development has nearly dewatered the coal aquifer within and immediately west of the general South Gillette analysis area.

Approved mining will continue to remove the Wasatch Formation overburden, Fort Union Formation interburden (where present), and coal on the existing leases at the four mines. The stratified units will be replaced with backfill material composed of an unlayered mixture of the shale, siltstone, and sandstone from the Wasatch Formation overburden and Fort Union Formation interburden. The existing leases include approximately 39,346.6 acres. Mining each of the LBA tracts as maintenance leases would extend the area of overburden and coal removal by about 11,886.9 acres under the Proposed Action up to about 12,464.8 acres under BLM's preferred tract configurations (Alternative 2 for the Belle Ayr North, Wet Coal Creek, and Caballo West LBA tracts and Alternative 3 for the Maysdorf II tract).

The 25-year Gillette Area Groundwater Monitoring Organization (GAGMO) report (Hydro-Engineering 2007) presents drawdowns that have developed in the last 25 years from coal mining activity or other stresses to the groundwater system. The 25-year drawdown map for the general South Gillette analysis area included in the report shows a continuous cone of depression around the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines due to their proximity to each other and the large drawdowns caused to the west by CBNG development. Hydro-Engineering (2007) states that the extent of drawdown caused by mining alone to the west of the mines can no longer be defined due to the much larger drawdown caused by CBNG development. Drawdowns to the west of the mines are very large, mainly due to the discharge of groundwater from the Wyodak coal aquifer that is associated with CBNG production. Greater drawdowns exist west of these mines than near their present western boundaries. The present drawdown of the Wyodak coal potentiometric surface has made the comparison between the 25-year drawdowns and the modeled groundwater drawdown predictions using the conservative, worst-case scenario for each mine to be unrealistic. Drawdowns in all areas have greatly increased in the last few years because of CBNG production. Potential overlapping impacts of the existing mining activities with other proposed activities are addressed further in chapter 4 of this EIS.

Due to the inconsistent lithologic makeup of the Wasatch Formation overburden (discontinuous sandstone and sand lenses in a matrix of siltstone and shale), drawdowns in the overburden are variable and do not extend great distances from the active mine pits. The varied nature of the water-bearing units within the Wasatch Formation overburden make the extent of water level drawdowns variable as well. Water level drawdowns propagate much farther and in a more consistent manner in the coal seam aquifers than in the overburden due to the regional continuity and higher transmissivity of the coal seam. Drawdowns in the coal seam are primarily a function of distance from the pit, although geologic and hydrologic barriers and boundaries (crop lines, fracture zones, and recharge sources) can also influence drawdowns. As discussed below, each mine evaluated groundwater level drawdowns resulting from their existing operations based on site-specific characteristics such as hydraulic conductivity, mining sequence, and local geology. Mines usually model groundwater level drawdown using the conservative, worst-case scenario. Therefore, it is unlikely that the actual drawdown will extend as far from the mine pits as predicted. It is also difficult to predict the time for groundwater recovery since each mine uses different predictive modeling techniques and assumptions, and reports different recovery times. In general, drawdown in groundwater levels in both the coal and overburden will be greatest adjacent to the pit area and decrease with distance from the pits (Ogle et al. 2005).

The subcoal aquifers (i.e., Tullock Member of the Fort Union Formation and Lance Formation-Fox Hills Sandstone) are not removed or disturbed by mining, so coal mining does not impact them. All four of the applicant mines located within the general South Gillette analysis area use water supply wells completed in aquifers stratigraphically below the Wyodak coal. If these four LBA tracts are leased and mined by the applicants, water would be produced from these wells for a longer period, but none of the mines would require additional sub-coal wells for industrial water supply to continue mining and reclaiming.

The existing layers of sediment and rock in the area of coal removal would be replaced by homogeneous, unconsolidated backfill material, which would recover as a single hydrostratigraphic unit. The backfill unit created in the LBA tract areas would be in hydraulic communication with the undisturbed coal, overburden, and the adjacent mine backfill. Premining recharge areas, described in section 3.5.1.1, would not be disturbed by mining. Surface infiltration recharge rates for the backfill materials should equal or be greater than infiltration recharge through undisturbed overburden, primarily due to the swelling mined strata attendant with excavating the strata, and due to flatter postmining topography resulting in less surface runoff. Water levels in the affected aquifers would remain below premining levels for a long time, since groundwater discharge rates from the affected aquifers into the proposed mine pits are expected to be low. Groundwater would accumulated in the backfill and eventually discharge to hydrostratigraphic units bordering the backfilled pit, at which time, groundwater levels and flow patterns are expected to be similar to premining condition. Groundwater flow

through the backfill and undisturbed bedrock near the pits would be interrupted until saturation levels in the backfilled pits have increased, and the rates of recharge to and discharge from the backfill have equilibrated. Postmining groundwater levels should approach steady state conditions some time after mine reclamation and impacts from CBNG development in the cumulative impact areas are completed. The rate at which the mine backfill resaturates and the postmining potentiometric surface reaches equilibrium depends on the hydraulic conductivity of the backfill and sources of recharge water.

The hydraulic properties of the backfill aquifer based on the results of aquifer testing at mines in the PRB are quite variable, although generally equal to or greater than the undisturbed overburden and coal aquifers (Van Voast et al. 1978 and Rahn 1976). It is early in the process of full reclamation and to date, not all of the backfilled materials have reached an adequate saturated thickness to be aquifer tested at the four applicant mines in the general South Gillette analysis area. The composition of the backfilled overburden materials at these four adjacent mines is quite similar; therefore, the hydraulic characteristics of the backfill at these four mines are also expected to be similar. To date, the backfill has not yet been aquifer tested at the Cordero Rojo and Coal Creek mines. Hydraulic conductivity values measured in existing monitoring wells completed in the saturated backfill at the Belle Ayr and Caballo mines range from 0.002 ft/day to 2.0 ft/day (FCW 2003 and CCC 2003), which is comparable but slightly lower than the reported hydraulic conductivity values determined for the Wasatch overburden and Wyodak coal seam. These data indicate that the backfill would readily resaturate as postmining potentiometric elevations recover in the surrounding undisturbed aquifers, and that wells completed in the backfill (including in these four LBA tracts) would be capable of supplying sufficient yields to wells constructed for livestock watering uses.

Mining and reclamation also impacts groundwater quality; the TDS concentration in the water resaturating the backfill is generally higher than the TDS concentration in groundwater from the overburden coal seam aquifers prior to mining. This is due to the increased porosity and surface area of backfilled overburden sediments, causing exposure of fresh mineral surfaces to groundwater that moves through the backfill and increased oxidation that occurs from exposure of sediments during mining. Scientific tests in the laboratory and in the field show the predominant cause for high dissolved-solids contents in mine backfill is the availability of highly soluble salts in the overburden sediments. The soluble salts that are exposed to groundwater are readily mobilized; therefore, groundwater quality in recently backfilled mine pits is highly diverse due to the variable distribution of soluble salts and the variable permeability of the backfill. As the backfill is resaturated and groundwater flow patterns are reestablished, the soluble salts are leached by groundwater inflow. Groundwater quality in the backfill depends on a balance between the introduction of new salts by groundwater that recharges the backfill and the flushing of the newly exposed soluble salts by groundwater flow. Studies of backfill groundwater quality are not

conclusive due to a relatively short period of monitoring available in the PRB. A general observation is that the content of TDS, calcium, magnesium, and sodium sulfates, when compared to the undisturbed aquifers, is roughly two to three times as high. However, these elevated levels should decline as flushing and leaching of soluble salts reaches equilibrium. Even at a two to three fold increase in TDS concentration, the water in the backfill will, in most cases, be suitable for its predominant premining use, stock watering (Straskraba 1986).

Using data compiled from 10 surface coal mines in the eastern PRB, Martin et al. (1988) concluded that backfill groundwater quality improves markedly after the backfill is leached with one pore volume of water. Van Voast and Reiten (1988) reached the same conclusions after analyzing data from the Decker and Colstrip mines located in the northern PRB. Their research indicates that upon initial saturation, mine backfill is generally high in TDS concentration and contains soluble salts (calcium, magnesium and sodium sulfates). TDS concentrations tend to decrease with time, indicating that the long-term groundwater quality in mined and adjacent lands would not be compromised. Clark (1995) conducted a study to determine if the decreases predicted by laboratory studies actually occur onsite. In the area of the West Decker Mine near Decker, Montana, Clark's study found that dissolved solids concentrations increased when water from an upgradient coal aquifer flowed into a backfill aquifer; and apparently decreased along an inferred flow path from a backfill aquifer to a downgradient coal aquifer. WDEQ/LQD calculated a median TDS concentration of 3,293 mg/L for the backfill aquifer in the east-central area of the PRB, including the mines in the general South Gillette analysis area, based on 1,384 samples (Ogle et al. 2005).

Changes to the premining hydraulic characteristics of the alluvial aquifer and the quality of alluvial groundwater are expected to be minor after final reclamation, because the applicant mines would be required to maintain the essential hydrologic functions of the alluvial valley floors (AVFs) declared in the general South Gillette analysis area and their alluvial aquifer systems (as is currently required for the already-approved mining operations). Additional discussions can be found in sections 3.5.1.3 and 3.6.

As discussed in chapter 2, the Proposed Action and action alternatives assume that these four LBA tracts would be leased as maintenance tracts to existing mines. Direct and indirect impacts to the groundwater system resulting from mining the tracts included in this analysis would add to the cumulative impacts that will occur from current mining. There have been drawdowns in the coal and overlying aquifers because of existing mining and ongoing CBNG development in the vicinity of the LBA tracts. As of 2005, the level of groundwater in the Wyodak coal seam had lowered to around 40 feet above the base of the coal in the general South Gillette analysis area.

The probable groundwater impacts from leasing and subsequent mining of each of the LBA tracts are described in the following paragraphs. Some or all of the

impacts to the groundwater levels in the coal aquifer described below may already be occurring as a result of current coal mining adjacent to the LBA tracts and CBNG development.

3.5.1.2.1.1 Belle Ayr North LBA Tract

The existing leases at the Belle Aye Mine include approximately 6,345.3 acres. Mining the Belle Ayr North LBA tract as a maintenance lease would extend the area of overburden and coal removal by about 1,937 acres under the Proposed Action and up to about 1,947 acres under Alternative 2, BLM's preferred tract configuration.

Mining has affected alluvial groundwater level elevations only where the alluvial aquifer has been mined out. If the Belle Ayr North LBA tract is leased, mining would dewater and physically remove the Duck Nest Creek alluvial materials within the tract. Changes to the premining hydraulic characteristics of the alluvial aquifer and the quality of the alluvial groundwater are expected to be minor after final reclamation, because Belle Ayr Mine would be required to maintain the essential hydrologic functions of Duck Nest Creek and its alluvial aquifer system. Additional discussions can be found in sections 3.5.1.3 and 3.6.

Overburden thickness in the tract range from about 120 feet to 400 feet and averages around 295 feet. Most of the overburden is composed of massive silty and clayey shales of very low permeability, although discontinuous, lenticular-shaped sand bodies occur in the general analysis area. Some of these isolated sand bodies in the overburden are saturated, but groundwater yields from them are generally low. Due to the discontinuous nature of the permeable overburden sediments, premining overburden groundwater movement followed the topography. Before mining, overburden groundwater flow in the vicinity of the Belle Ayr Mine was toward, and discharged to the Belle Fourche River and Caballo Creek valleys. Groundwater flow has since been affected by the removal of overburden. Monitor well data indicate that overburden groundwater in the Belle Ayr North general analysis area now flows toward the Belle Ayr Mine's and neighboring mines' open pits. Mining has and will continue to depress water levels in the overburden, although the historical monitoring data do not indicate a correlation between water level drawdown in the overburden to distance and direction from the open pits. In general, overburden groundwater levels will begin to show steady decline in areas that are within about ½ mile of the mine pits as mining progresses. Future drawdown in the overburden is expected to be similar to that measured to date, and would be expected to continue to have a limited impact outside of the mined area.

Water level drawdowns have propagated much farther and in a more consistent manner in the Wyodak coal seam aquifer than in the overburden. Groundwater level monitoring data collected by the Belle Ayr Mine and the other three mines located in the general South Gillette analysis area and presented in the GAGMO

25-year report (Hydro-Engineering 2007) indicate that the groundwater flow directions in the Wyodak coal have been greatly influenced by surface mine dewatering and groundwater discharge associated with CBNG development. Groundwater levels observed near active mining areas before 1997 were likely due to mine dewatering alone. The groundwater flow direction within the coal aquifer was typically toward the mine where it would drain by gravity into the open pits. By 2000, groundwater level decline rates had dramatically increased because drawdown caused by widespread CBNG development west of the mines was overlapping with drawdown caused by mining operations. A continuous cone of depression currently exists around the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines due to their closeness to each other and the cumulative drawdown effects from pit dewatering and nearby CBNG discharges (Hydro-Engineering 2007). The extent of drawdown west of the mines that is specifically attributable to mine dewatering can no longer be defined due to much greater and areally extensive drawdown caused by CBNG development.

Recent coal seam water level data presented in the GAGMO 25-year report (Hydro-Engineering 2007) illustrate that approximately 150 feet of drawdown has occurred near the western edge of the Belle Ayr North LBA tract, and approximately 50 feet of drawdown has occurred near the tract's eastern edge. The 2005 coal seam water level contours in the area of the four mines depict the groundwater flow direction to be entirely to the west, away from the open pits. Roughly 30 years of surface mining and CBNG development has resulted in nearly complete dewatering of the coal seams in localized areas, particularly near the mines' pits and where the coal seams are structurally highest.

In 1997, the numerical groundwater flow model MODFLOW was used to predict the extent of water level drawdown in the Wyodak coal aquifer attributable to mining the existing leases at the Belle Ayr Mine. The results of the groundwater modeling are reported in Appendix 3.5-7 of the Belle Ayr Mine Permit 214-T6 (FCW 2003). Groundwater level monitoring data prior to CBNG activity approximated the modeled drawdown predictions done in 1997. For the purpose of this analysis, the extent of coal-mining related drawdown (5-foot contour) in the Wyodak seam over the life of the Belle Ayr Mine if the Belle Ayr North LBA tract is mined was extrapolated by extending FCW's 1997-modeled life-of-mine drawdown contour to the north and west by the dimensions of the Belle Ayr North LBA tract (figure 3-21). The area subject to lower water levels would increase roughly in proportion to the increase in area mined. This extrapolation serves as a general approximation of the potential impacts, based on experience, but it does not take variations in hydrologic properties, the time the pits are open, and the distance from previous mining and CBNG development into account.

The rate and extent of the actual drawdown in the coal became much greater than the modeled drawdown in the late 1990s, effectively rendering the MODFLOW prediction obsolete. This occurred as drawdown caused by extensive CBNG development west of the Belle Ayr Mine permit area and the Belle Ayr North LBA

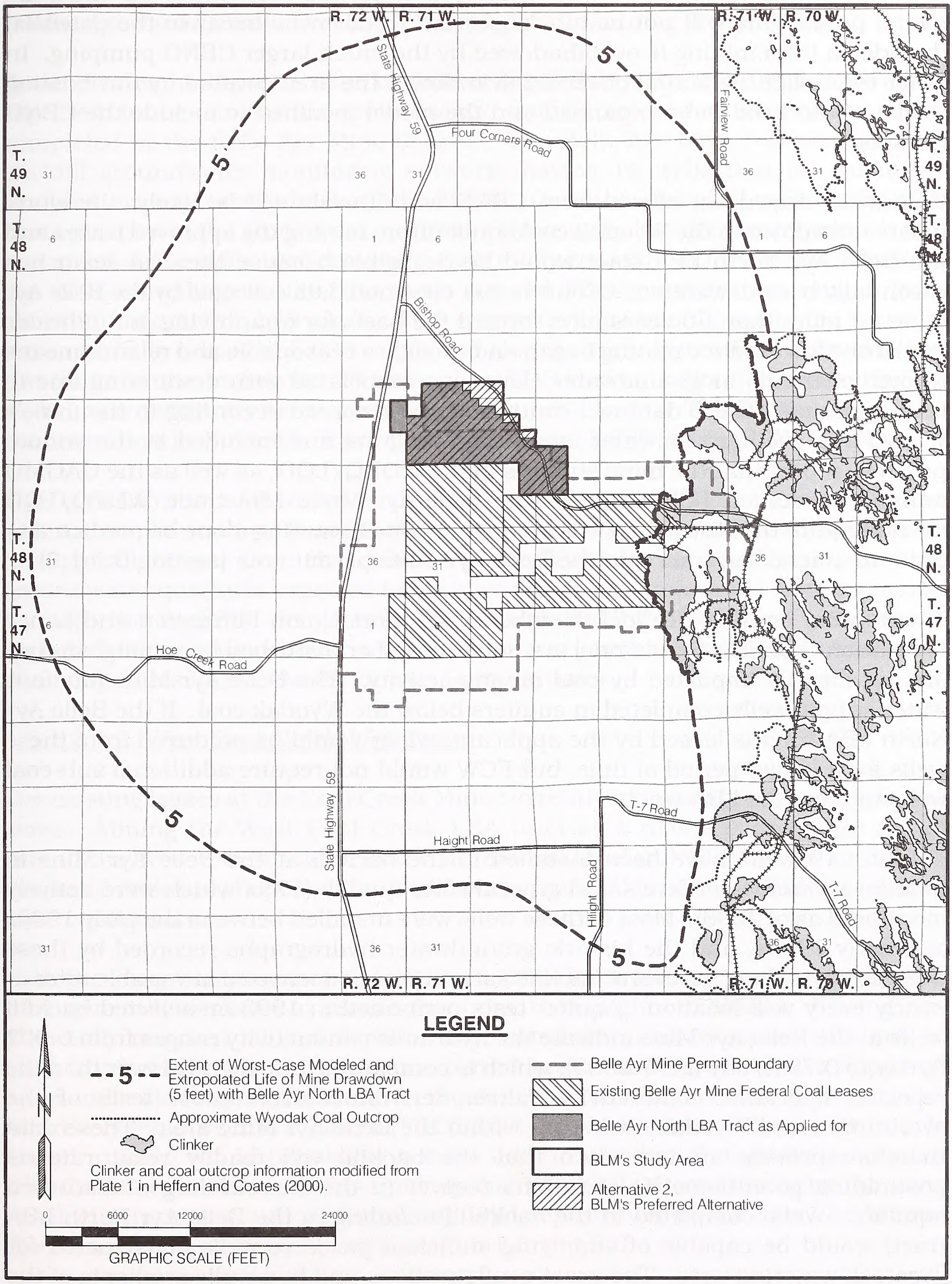


Figure 3-21. Belle Ayr Mine Life of Mine Drawdown Map, Resulting from Currently Approved Mining with the Addition of the Belle Ayr North LBA Tract.

tract has overlapped with drawdown caused by mining operations. As such, the model predictions will not match "observed" drawdowns because the potential drawdown from mining is overshadowed by the much larger CBNG pumping. In order to predict the actual observed drawdown, the area covered by the existing model would need to be expanded and the model modified to include the CBNG pumpage.

Continued drawdown effects from CBNG withdrawals will be likely; therefore, future drawdown to the Wyodak coal aquifer from mining the approved leases and the Belle Ayr North LBA tract would be negligible because the coal seam has essentially been dewatered. Groundwater elevation data collected by the Belle Ayr Mine for more than 30 years have formed the basis for quantifying groundwater level drawdowns since mining began and provide a reasonable and reliable means to predict trends in groundwater elevations associated with dewatering due to future mining. These data will continue to be recorded according to the mine's WDEQ-approved groundwater monitoring program and included in the annual progress report that the mine submits to the WDEQ/LQD, as well as the GAGMO annual reports. If FCW acquires the Belle Ayr North LBA tract, WDEQ/LQD would require that future drawdown impacts due to mining alone be predicted in order to amend the tract into the Belle Ayr Mine permit area (section 3.5.1.3).

The subcoal aquifers (Tullock Member of the Fort Union Formation and Lance Formation-Fox Hills Sandstone) are not removed or disturbed by mining, so they are not directly impacted by coal mining activity. The Belle Ayr Mine has four water supply wells completed in aquifers below the Wyodak coal. If the Belle Ayr North LBA tract is leased by the applicant, water would be produced from these wells for a longer period of time, but FCW would not require additional sub-coal wells to mine the LBA tract.

To date, 19 wells have been installed in the backfill at the Belle Ayr Mine to monitor groundwater levels and groundwater quality (17 of which were actively monitored as of 2006). Most of these wells were installed between the early 1980s and early 1990s, and the historic groundwater hydrographs recorded by these wells indicate that the level of backfill saturation has increased at variable rates at nearly every well location. Aquifer tests performed in 1993 on selected backfill wells at the Belle Ayr Mine indicate the hydraulic conductivity ranges from 0.002 ft/day to 0.78 ft/day (FCW 2003), which is comparable but slightly lower than the reported hydraulic conductivity values determined from most tests of the overburden and Wyodak coal seam within the Belle Ayr Mine area. These data therefore provide an indication that the backfill will readily resaturate as postmining potentiometric elevations recover in the surrounding undisturbed aquifers. Wells completed in the backfill (including in the Belle Ayr North LBA tract) would be capable of supplying sufficient yields to wells constructed for livestock watering uses. The exact configurations and hydraulic gradients of the postmining potentiometric surfaces may vary from premine conditions, reflecting the composite of overburden and coal heads in the backfill aquifer. However,

postmining equilibrium groundwater movement should exhibit a hydraulic gradient toward Caballo Creek, as existed prior to mining (FCW 2003).

Groundwater quality within the backfill at the Belle Ayr North LBA tract would be expected to be similar to groundwater quality measured in existing wells completed in the Belle Ayr Mine backfill. The Belle Ayr Mine has an extensive backfill groundwater monitoring network, having 14 wells that are currently sampled on a quarterly basis (FCW 2007). Over the period of record, the TDS concentration of the groundwater at five of these wells has decreased, while it has increased at five wells, and remained essentially constant at four wells. Based on the 2006 sampling results, the mean annual TDS concentration ranged from about 760 mg/L to 5,580 mg/L. TDS concentrations in only one of the 14 wells have normally exceeded 5,000 mg/L, but they have consistently remained below this value in the remaining 13 wells. The TDS concentration in three of the 14 wells has consistently been around or under 1,000 mg/L. The 2006 average TDS concentration in the entire 14-well database was 2,889 mg/L (FCW 2007).

TDS concentrations observed in the Belle Ayr Mine backfill monitoring wells to date are similar to those found in the undisturbed Wasatch Formation overburden but typically larger than those found in the Wyodak coal aquifer. Postmining groundwater quality is expected to improve after one pore volume of water moves through the backfill. In general, the mine backfill groundwater TDS can be expected to be quite similar to the premining overburden aquifer, and meet Wyoming Class III standards for use as stock water.

3.5.1.2.1.2 West Coal Creek LBA Tract

The existing leases at the Coal Creek Mine currently include approximately 6,854 acres. Mining the West Coal Creek LBA tract as a maintenance lease would extend the area of overburden and coal removal by about 1,925 acres under the Proposed Action and up to about 2,210 acres under Alternative 2, BLM's preferred tract configuration.

With the exception of seasonal variations, Coal Creek alluvial groundwater levels have generally declined in recent years due to drought conditions. Mining has physically removed alluvial deposits associated with one unnamed tributary of Coal Creek within the current mine permit area. Coal Creek Mine's approved mine and reclamation plan does not require that Coal Creek's alluvial deposits be selectively removed and replaced (TBCC 2006). If the West Coal Creek LBA tract is leased, mining would physically remove additional alluvial deposits associated with Coal Creek. However, it is unlikely that WDEQ/LQD would require the mine to selectively remove and replace the alluvial deposits within the tract. Additional discussions can be found in sections 3.5.1.3 and 3.6.

Hydrologic baseline studies conducted by TBCC in the Coal Creek Mine area and the West Coal Creek general analysis area concluded that the Wasatch Formation

overburden is an aquitard that lacks saturated areas (e.g., paleochannel sands) capable of yielding enough water to justify well construction (TBCC 2006). Therefore, due to the lack of a continuous saturated zone within the overburden, there have been no impacts to an overburden aquifer from mining and no impacts are anticipated if the West Coal Creek LBA tract is leased and mined.

Groundwater level monitoring data collected by the Coal Creek Mine and the other three mines located in the general South Gillette analysis area indicate that the groundwater flow directions in the Wyodak-Anderson coal aquifer have been greatly influenced by surface mine dewatering and groundwater discharge associated with CBNG development. Coal Creek Mine development began in 1982 and groundwater level declines observed at coal monitoring wells located near active mining areas prior to 1997 were due to mine dewatering alone. The groundwater flow direction within the coal aquifer was typically toward the mine where it would drain by gravity into the open pits. By 2000, groundwater level decline rates had dramatically increased because drawdown caused by widespread CBNG development west of the mine was overlapping with drawdown caused by mining operations. As such, model drawdown predictions will not match "observed" drawdowns because the potential drawdown from mining is overshadowed by the much larger CBNG pumping. In order to predict the actual observed drawdown, the area covered by the existing model would need to be expanded and the model modified to include the CBNG pumpage.

Recent coal seam water level data presented in the GAGMO 25-year report (Hydro-Engineering 2007) and Coal Creek Mine's 2007 WDEQ/LQD annual report (TBCC 2007) indicate that from 50 to 70 feet of drawdown has occurred near the western edge of the West Coal Creek LBA tract. Wyodak-Anderson coal monitoring wells located more than ½ mile west of the West Coal Creek general analysis area have shown drawdowns over 400 feet due to CBNG development, whereas drawdowns between 25 and 50 feet have occurred in monitor wells located within ½ mile of the mine's open pits. The 2005 coal seam water level contours in the West Coal Creek general analysis area depict the groundwater flow direction to be west-northwest, rather than towards Coal Creek Mine's open pits to the east-northeast (Hydro-Engineering 2007).

In 2005, the extent of water level drawdown in the coal aquifer attributable to mining the existing leases at the Coal Creek Mine was estimated using the analytical line sink method. The results of the line sink analysis are reported in Addendum 3.5.1 of the Coal Creek Mine Permit 483-T5 (TBCC 2006). For this analysis, the extent of coal-mining related drawdown (5-foot contour) in the Wyodak-Anderson seam over the life of the Coal Creek Mine if the West Coal Creek LBA tract is mined was extrapolated by extending TBCC's predicted life of mine, line sink drawdown contour to the north, west, and south by the dimensions of the LBA tract (figure 3-22). The area subject to lower water levels would increase roughly in proportion to the increase in area mined. This extrapolation serves as a general approximation of the potential impacts, based on experience, but it does

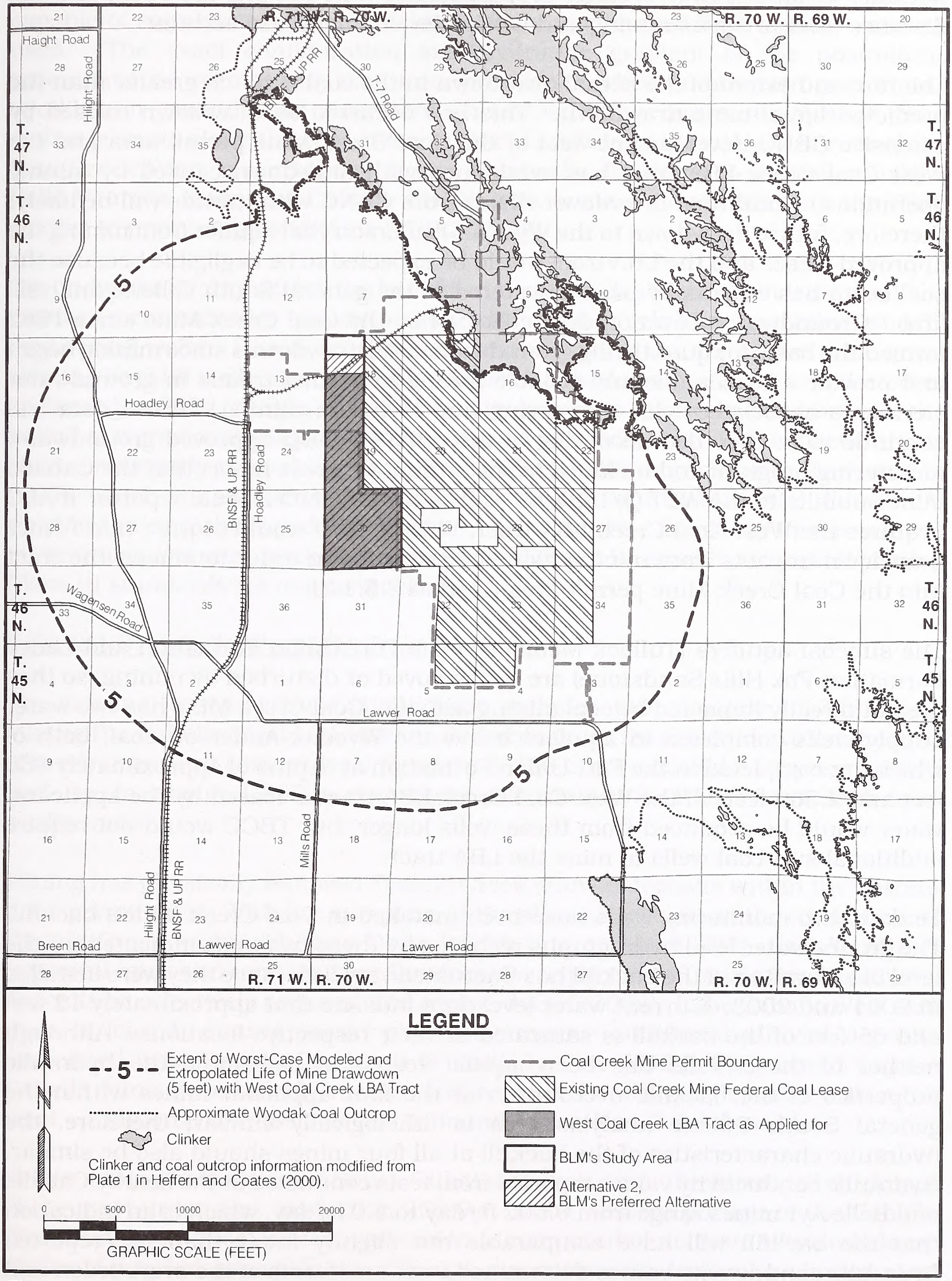


Figure 3-22. Coal Creek Mine Life of Mine Drawdown Map, Resulting from Currently Approved Mining with the Addition of the West Coal Creek LBA Tract.

not take variations in hydrologic properties, the time the pits are open, and the distance from previous mining and CBNG development into account

The rate and extent of the actual drawdown in the coal is much greater than the predicted life-of-mine drawdown. This has occurred as drawdown caused by extensive CBNG development west of the Coal Creek Mine permit area and the West Coal Creek LBA tract has overlapped with drawdown caused by mining operations. Continued drawdown effects from CBNG withdrawals will be likely; therefore, future drawdown to the Wyodak-Anderson coal aquifer from mining the approved leases and the LBA tract would be expected to be negligible because the coal seam has essentially been dewatered in the general South Gillette analysis area. Groundwater elevation data collected by the Coal Creek Mine since 1982 formed the basis for quantifying groundwater level drawdowns since mining began and provide a reasonable and reliable means to predict trends in groundwater elevations associated with dewatering due to future mining. These data will continue to be recorded according to the mine's WDEQ-approved groundwater monitoring program and included in the annual progress report that the Caballo Mine submits to the WDEQ/LQD, as well as the GAGMO annual reports. If ALC acquires the West Coal Creek LBA tract, WDEQ/LQD would require that future drawdown impacts from mining alone be predicted in order to amend the tract into the Coal Creek Mine permit area (section 3.5.1.3).

The subcoal aquifers (Tullock Member of the Fort Union Formation and Lance Formation-Fox Hills Sandstone) are not removed or disturbed by mining, so they are not directly impacted by coal mining activity. Coal Creek Mine has two water supply wells completed in aquifers below the Wyodak-Anderson coal; both of which are completed in the Fort Union Formation at depths of approximately 850 feet and 2,500 feet. If the West Coal Creek LBA tract is leased by the applicant, water would be produced from these wells longer, but TBCC would not require additional sub-coal wells to mine the LBA tract.

To date, two monitoring wells have been installed in Coal Creek Mine's backfill. The groundwater level hydrographs recorded by these two wells indicate that the level of saturation in the backfill has fluctuated very little since they were installed in 2001 and 2003. Current water level data indicate that approximately 12 feet and 65 feet of the backfill is saturated at their respective locations. Although neither of these wells has been aquifer tested to determine the hydraulic properties of the backfill, overburden at the four applicant mines within the general South Gillette analysis area is lithologically similar; therefore, the hydraulic characteristics of the backfill at all four mines should also be similar. Hydraulic conductivity values reported from tests conducted at the nearby Caballo and Belle Ayr mines range from 0.002 ft/day to 2.0 ft/day, which is an indication that the backfill will have comparable but slightly lower than the reported hydraulic conductivity values determined from most tests of the overburden and Wyodak coal seam. The backfill should readily resaturate as postmining potentiometric elevations recover in the surrounding undisturbed aquifers. Wells

completed in the backfill (including in the West Coal Creek LBA tract) would be capable of supplying sufficient yields to wells constructed for livestock watering uses. The exact configuration and hydraulic gradient of the postmining potentiometric surface may vary from premine conditions; however, postmining equilibrium groundwater movement should exhibit a hydraulic gradient from recharge areas along the coal outcrop east of and along the eastern border of the Coal Creek Mine, toward the west and eventually discharge to the valleys of the Belle Fourche River and Caballo Creek, with some regional flow into the PRB, similar to premining conditions (TBCC 2006).

Groundwater quality within the backfill at the West Coal Creek LBA tract would be similar to groundwater quality measured in Coal Creek Mine's existing backfill monitoring wells. Based on the historical sampling results of the mine's two existing backfill wells, one of which has been sampled since 2002 and the other beginning in 2004, the groundwater quality has been relatively constant over the period of record and relatively similar at both well locations. TDS concentrations have consistently ranged from around 2,700 to 3,000 mg/L (Hydro-Engineering 2007), which are similar to those found in the undisturbed Wasatch Formation overburden and the Wyodak-Anderson coal aquifers. Based upon the current information, the mine backfill groundwater TDS can be expected to meet Wyoming Class III standards for use as stock water.

3.5.1.2.1.3 Caballo West LBA Tract

The existing leases at the Caballo Mine include approximately 11,705 acres. Mining the Caballo West LBA tract as a maintenance lease would extend the area of overburden and coal removal by about 1,350 acres under the Proposed Action and up to about 1,390 acres under Alternative 2, BLM's preferred tract configuration.

Mining has physically removed Tisdale Creek alluvial deposits within the current mine permit area. With the exception of the alluvial deposits at the confluence of Tisdale Creek and Gold Mine Draw (which is a declared AVF), Caballo Mine's approved mine and reclamation plan does not require that Tisdale Creek's alluvial deposits be selectively removed and replaced (CCC 2003). If the Caballo West LBA tract is leased, mining would physically remove additional alluvial deposits associated with Tisdale Creek. It is unlikely that WDEQ/LQD would require Caballo Mine to selectively remove and replace the alluvial deposits within the tract. Additional discussions can be found in sections 3.5.1.3 and 3.6.

Before mining in the general South Gillette analysis area, the saturated thickness of the overburden was more than 200 feet in the western portion of the Caballo West LBA tract. Most of the overburden is composed of massive silty and clayey shales of very low permeability, although discontinuous, lenticular-shaped sand bodies (paleochannel sands) occur in the Caballo West general analysis area. Some of these isolated sand bodies in the overburden are saturated, and

groundwater yields from them may be great enough to necessitate pre-mine dewatering in order to improve highwall stability. Because of the discontinuous nature of the permeable overburden sediments, premining overburden groundwater movement generally followed the topography, and before mining, overburden groundwater flow in the vicinity of the Caballo Mine was generally toward, and discharged to the Caballo Creek valley. Groundwater flow has since been affected by dewatering and removing overburden. Monitor well data indicate that overburden groundwater in the Caballo West general analysis area now flows toward the Caballo Mine's and neighboring mines' open pits. However, water levels in overburden monitoring wells located more than 500 feet from the pits have shown no significant decline and any changes are generally only in response to seasonal fluctuations. Overburden groundwater levels in the vicinity of the Caballo West analysis area vary from approximately 25 feet to over 180 feet below land surface (Hydro-Engineering 2007). Mining operations have and will continue to depress water levels in the overburden, although the historical monitoring data do not indicate a correlation between water level drawdown in the overburden to distance and direction from the open pits. In general, overburden groundwater levels will begin to show steady decline in areas that are within about ½ mile of the mine pits as mining progresses. Future drawdown in the overburden is expected to be similar to that measured to date and would be expected to continue to have a limited impact outside of the mined area.

Water level drawdowns have propagated much farther and in a more consistent manner in the Wyodak coal seam aquifer than in the overburden. Groundwater level monitoring data collected by the Caballo Mine and the other three mines located in the general South Gillette analysis area and presented in the GAGMO 25-year report (Hydro-Engineering 2007) indicate that the groundwater flow directions in the Wyodak coal have been greatly influenced by surface mine dewatering and groundwater discharge associated with CBNG development. Groundwater levels observed near the active mining areas prior to 1997 were likely due to mine dewatering alone. The groundwater flow direction within the coal aquifer was typically toward the mines where it would drain by gravity into the open pits. By 2000, groundwater level decline rates had dramatically increased because drawdown caused by widespread CBNG development west of the mines was overlapping with drawdown caused by mining operations. A continuous cone of depression currently exists around the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines due to their closeness to each other and the cumulative drawdown effects from pit dewatering and nearby CBNG discharges. The extent of drawdown west of the mines that is specifically attributable to mine dewatering can no longer be defined due to much greater and areally extensive drawdown caused by CBNG development.

Recent coal seam water level data presented in the GAGMO 25-year report (Hydro-Engineering 2007) and Caballo Mine's 2007 WDEQ/LQD annual report (CCC 2007) illustrate that approximately 150 feet of drawdown has occurred near the western edge of the Caballo West LBA tract, and approximately 80 feet of

drawdown has occurred near the LBA tract's eastern edge, which is nearly 1 mile west of the Caballo Mine pits. Coal monitoring wells located over 1 mile north of the LBA tract had also recorded around 150 feet of drawdown. Due to safety, environmental, and economic reasons, many of the Caballo Mine's coal monitoring wells west and north of the mine have been plugged and abandoned to prevent methane gas from escaping. The 2005 coal seam water level contours in the general South Gillette analysis area depict the groundwater flow direction to be predominantly to the west, away from the open pits (Hydro-Engineering 2007). Roughly 30 years of surface mining and CBNG development has resulted in nearly complete dewatering of the coal seams in localized areas, particularly near the mines' pits and where the coal seams are structurally highest.

In 1999, the numerical groundwater flow model MODFLOW was used to predict the extent of water level drawdown in the Wyodak coal aquifer attributable to mining the existing leases at the Caballo Mine. The results of the groundwater modeling are reported in Addendum MP-C of the Caballo Mine Permit 433-T5 (CCC 2003). Groundwater level monitoring data through 1990, prior to CBNG activity, were selected to compare the observed to the predicted drawdown, and the verification provided good correlation to the 1990 conditions of the modeled area. For the purpose of this analysis, the extent of coal-mining related drawdown (5-foot contour) in the Wyodak seam over the life of the Caballo Mine if the Caballo West LBA tract is mined was extrapolated by extending CCC's 1999-modeled life-of-mine drawdown contour to the north and west by the dimensions of the Caballo West LBA tract (figure 3-23). The area subject to lower water levels would increase roughly in proportion to the increase in area mined. This extrapolation serves as a general approximation of the potential impacts, based on experience, but it does not take variations in hydrologic properties, the time the pits are open, and the distance from previous mining and CBNG development into account.

The rate and extent of the actual drawdown in the coal became much greater than the modeled drawdown in the late 1990s, effectively rendering the MODFLOW prediction obsolete. This occurred as drawdown caused by extensive CBNG development west of the Caballo Mine permit area and the Caballo West LBA tract overlapped with drawdown caused by mining. As such, the model predictions will not match "observed" drawdowns because the potential drawdown from mining is overshadowed by the much larger CBNG pumping. In order to predict the actual observed drawdown, the area covered by the existing model would need to be expanded and the model modified to include the CBNG pumpage.

Continued drawdown effects from CBNG withdrawals will be likely; therefore, future drawdown to the Wyodak coal aquifer from mining the approved leases and the LBA tract would be negligible because the coal seam has essentially been dewatered. Groundwater elevation data collected by the Caballo Mine for nearly 30 years have formed the basis for quantifying groundwater level drawdowns since mining began and provide a reasonable and reliable means to predict trends in groundwater elevations associated with dewatering due to future mining. These

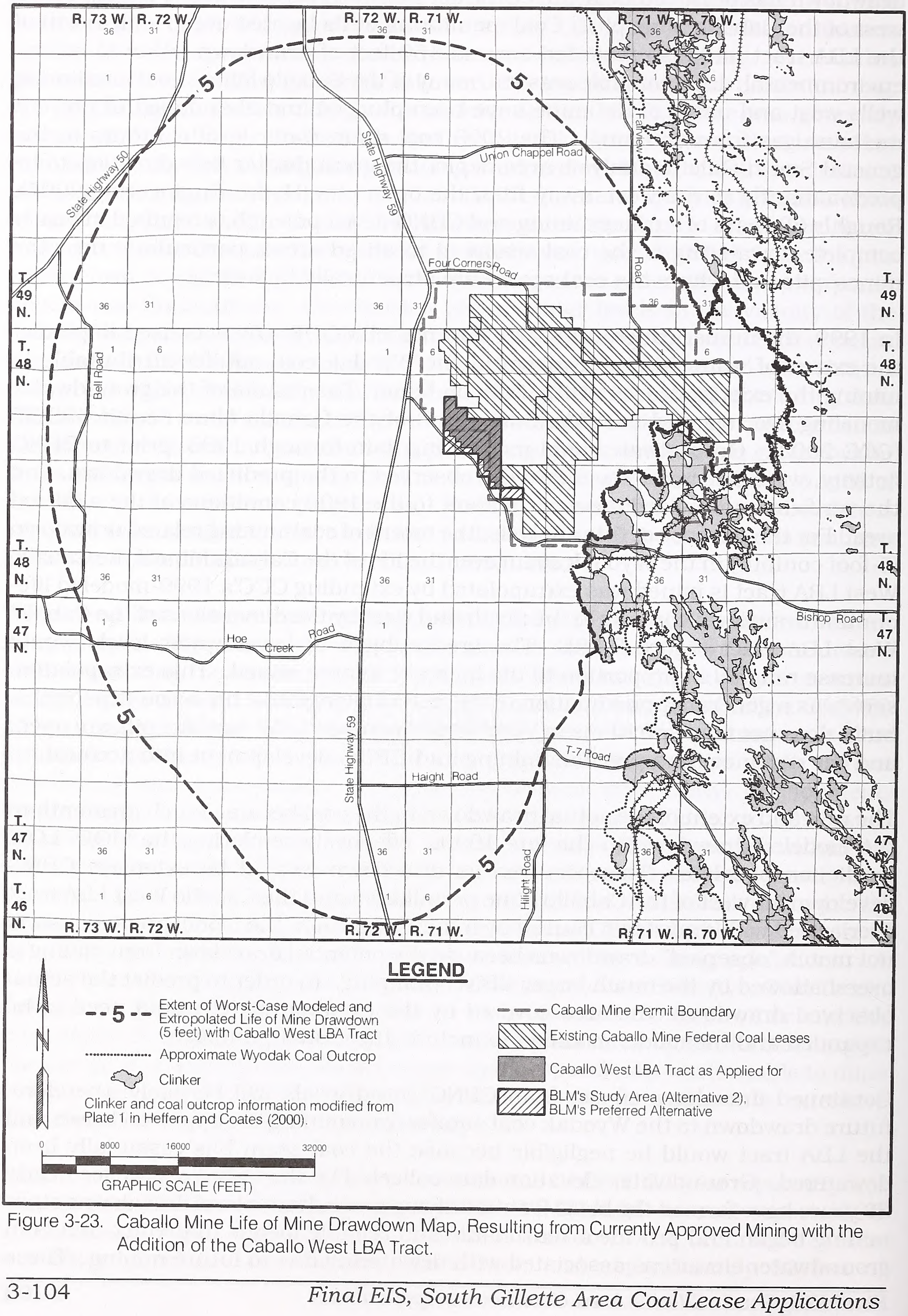


Figure 3-23. Caballo Mine Life of Mine Drawdown Map, Resulting from Currently Approved Mining with the Addition of the Caballo West LBA Tract.

data will continue to be recorded according to the mine's WDEQ-approved groundwater monitoring program and included in the annual progress report that the Caballo Mine submits to the WDEQ/LQD, as well as the GAGMO annual reports. If CCC acquires the Caballo West LBA tract, WDEQ/LQD would require that future drawdown impacts due to mining alone be predicted in order to amend the tract into the Caballo Mine permit area (section 3.5.1.3).

The subcoal aquifers (i.e., Tullock Member of the Fort Union Formation and Lance Formation-Fox Hills Sandstone) are not removed or disturbed by mining, so they are not directly impacted by coal mining activity. The Caballo Mine has three water supply wells completed in aquifers below the Wyodak coal; two in the Fort Union Formation and one in the Fox Hills Sandstone. If the Caballo West LBA tract is leased by the applicant, water would be produced from these wells for a longer period of time, but CCC would not require additional sub-coal wells to mine the LBA tract.

To date, 18 wells have been installed to monitor water levels and water quality in the backfill at Caballo Mine. Ten of these wells were constructed between 1981 and 1984, four additional backfill wells were constructed between 1984 and 1989, and the remaining four wells were installed between 1989 and 1998. Eight of these backfill wells were included in the mine's current (2007) groundwater monitoring program. The groundwater level hydrographs recorded by these wells over the period of record indicate that the level of saturation in the backfill has fluctuated considerably and largely depends on the well's location with respect to the thickness of backfill, the physical characteristics of the backfill materials, and the source of groundwater recharge. Groundwater levels have increased by 5 to 12 feet at six well locations, remained stable at one well location, and declined 9 feet at the remaining well location (CCC 2007). In general, water level recovery has been greatest near recharge areas (the reclaimed Tisdale Creek channel and the coal crop line in the southeastern portion of the mine's permit area).

Aquifer tests performed to date on selected backfill wells at the Caballo Mine indicate the hydraulic conductivity ranges from 0.09 ft/day to 2.0 ft/day (CCC 2003), which is comparable but slightly lower than the reported hydraulic conductivity values determined from most tests of the overburden and Wyodak coal seam within Caballo Mine's permit area. Aquifer tests conducted on wells completed in backfill comprised primarily of alluvial deposits from the Tisdale Creek drainage show hydraulic conductivity values ranging from 0.5 ft/day to 28.3 ft/day, which is much higher than that of the overburden and coal seam at the mine. These data provide an indication that the backfill will readily resaturate as postmining potentiometric elevations recover in the surrounding undisturbed aquifers. The wells completed in the backfill (including in the Caballo West LBA tract) would be capable of supplying sufficient yields to wells constructed for livestock watering uses. The exact configuration and hydraulic gradient of the postmining potentiometric surface may vary from premine conditions; however,

postmining equilibrium groundwater movement should exhibit a hydraulic gradient from east to west, as existed prior to mining (CCC 2003).

Groundwater quality observed in Caballo Mine's backfill is a function of the backfill material at the sampled well's location as well as the source of recharge water (CCC 2003). The ten backfill monitoring wells that were constructed between 1981 and 1984 are all located in an area of the mine's backfill that yields groundwater of relatively poor quality. Most of the samples collected initially from these wells had high TDS, selenium, and nitrate concentrations that exceeded Wyoming Class III standards for use as stock water. These ten wells were constructed in an area of the backfill that contains large amounts of alluvial material (originating from the Tisdale Creek drainage), which prior to mining yielded alluvial groundwater of very poor quality. The TDS, selenium, and nitrate concentrations at these wells have declined significantly over time. The four wells that were constructed between 1984 and 1989 are located in a different area of the mine's backfill (originating from upland areas) that yields groundwater of much better quality. Groundwater samples collected from three of the mine's remaining four backfill monitoring wells, which were installed between 1989 and 1998 in yet another area of the mine's backfill, are of relatively good quality, meeting Wyoming Class III standards (CCC 2003 and Murphree 2005).

TDS concentrations observed in the Caballo Mine backfill monitoring wells to date are similar to those found in the undisturbed alluvial and Wasatch Formation overburden aquifers, but greater than those found in the Wyodak coal aquifer. Postmining groundwater quality is expected to improve after one pore volume of water moves through the backfill. In general, the mine's backfill groundwater quality can be expected to be similar to the premining overburden aquifer and meet Wyoming Class III standards; however, there could be localized areas in the backfill that yield groundwater that does not meet Wyoming Class III standards, particularly where the poorer quality alluvial materials happen to be concentrated. Groundwater quality within the backfill at the Caballo West LBA tract would be expected to be similar to groundwater quality measured in existing wells completed in the Caballo Mine backfill.

3.5.1.2.1.4 Maysdorf II LBA Tract

The existing leases at the Cordero Rojo Mine currently include approximately 14,442.4 acres. Mining the Maysdorf II LBA tract as a maintenance lease would extend the area of overburden and coal removal by about 6,675 acres under the Proposed Action up to about 6,917 acres under Alternative 3, BLM's preferred tract configuration.

With the exception of seasonal variations, alluvial groundwater levels adjacent to the Belle Fourche River have remained constant. Except for locations where the alluvium has been mined out, or where the river has been diverted, mining has not affected alluvial groundwater elevations, and is not expected to do so in the

future, except where mining physically removes the alluvium, diverts the Belle Fourche River, or removes a source of recharge to the alluvium (CMC 2007a). Changes to the premining hydraulic characteristics of the alluvial aquifer and the quality of the alluvial groundwater are expected to be minor after final reclamation, because Cordero Rojo Mine is required to maintain the essential hydrologic functions of the Belle Fourche River and its alluvial groundwater system. Additional discussion can be found in section 3.5.1.3.

Mining has directly impacted overburden groundwater within the mined areas by removing the water-bearing strata in the overburden, resulting in dewatering of the aquifer near the mine. Overburden groundwater levels ahead of (generally west) and adjacent to the mine have exhibited considerable variation. Mining has not necessarily caused water drawdowns in the overburden to be depressed in proportion to distance and direction from the open pits or in time since mining began. Water levels in overburden monitoring wells located more than about ½ mile from the Cordero Rojo Mine pits have shown no significant decline. Overburden at the mine-pit face is typically fully dewatered, so the overburden's potentiometric surface steepens considerably near the pits. Future drawdown in the overburden is expected to be similar to that measured to date, and would be expected to continue to have a limited impact outside of the mined area.

Water level drawdowns propagate much farther and in a more consistent manner in the Wyodak coal seam than in the overburden because of the coal aquifer's regional continuity and higher transmissivity. Coal groundwater has experienced the most pronounced drawdowns, and exhibits a spatially broader range of drawdown compared to that in the overburden (CMC 2007a). Cumulative drawdowns within the coal from 1980 to 1995 were in excess of 5 feet within 12 miles west and 3 miles south of the active pits at the Cordero Rojo Mine (Hydro-Engineering 1996). Water level declines in most of the mine's coal monitoring wells were gradual and mainly due to mine dewatering alone until 1994. Preliminary and experimental CBNG production immediately west of the mine began in 1994, and then increased to full-scale production by 1998. Because of CBNG development, larger water level declines began to appear in coal wells located roughly 3 miles or more west of the active pits than were observed in coal wells located within 3 miles of the open pits. Since 1995, coal monitoring wells located more than 1 mile west of the mine pits have recorded an increased rate of drawdown because of dewatering associated with CBNG production. By 2000, the extent of drawdown to the west of the Cordero Rojo Mine caused by mine dewatering could not be defined due to the much larger drawdown caused by CBNG development (Hydro-Engineering 2001a). In 2000, monitoring wells located within 1 mile west of the mine pits had recorded less than 100 feet of historical drawdown. However, monitoring wells located 3 or more miles west of the mine pits had recorded total drawdowns of 150 feet or more. Near Wyoming 59, which was 4 to 5 miles west of the mine pits in 2000, approximately 180 feet of drawdown had occurred (Hydro-Engineering 2001a). As of 2003, minimal additional drawdown had occurred immediately west of the advancing pits,

although an additional 60 to 80 feet of drawdown had occurred in the vicinity of Wyoming 59 (Hydro-Engineering 2004). As of 2007, dewatering by existing mining and CBNG development activities had nearly completely drained the groundwater from the Wyodak coal aquifer in the area of the Cordero Rojo Mine, particularly where the coal seam is structurally highest. The Wyodak coal aquifer's groundwater level is around 40 feet above the base of the seam within the Maysdorf II general analysis area. The direction of groundwater flow within that same area is predominantly to the west rather than towards Cordero Rojo Mine's open pits to the east (Hydro-Engineering 2007 and CMC 2007a).

The numerical groundwater flow model MODFLOW was used to predict the long-term, cumulative water level drawdown in the Wyodak coal aquifer attributable to mining the existing leases at the Caballo, Belle Ayr, Cordero Rojo, and Coal Creek mines. The results of these predictions are included within the Cordero Rojo Mine permit (CMC 2007a). Overall, actual groundwater level monitoring data prior to CBNG activity approximated the modeled drawdown predictions impacts relatively well through the mid-1990s. However, both the rate and extent of the actual drawdown in the coal became much greater than the modeled drawdown in the late 1990s, effectively rendering the MODFLOW prediction obsolete. This has occurred as drawdown caused by extensive CBNG development west of the Cordero Rojo Mine permit area and within and west of the Maysdorf II LBA tract has overlapped with drawdown caused by mining operations. Drawdown in the coal has substantially exceeded the modeled predictions due to CBNG production and will likely continue as long as CBNG production continues (CMC 2007a). As such, the model predictions will not match "observed" drawdowns because the potential drawdown from mining is overshadowed by the much larger CBNG pumping. In order to predict the actual observed drawdown, the area covered by the existing model would need to be expanded and the model modified to include the CBNG pumpage. Historic drawdowns observed at the Cordero Rojo Mine are addressed within the mine's approved permit. The extent of the life-of-mine Wyodak coal drawdown attributed to mining only the existing leases is not included in the analysis. If the mine acquires the Maysdorf II LBA tract, WDEQ/LQD would require that future drawdown impacts due to mining alone be predicted in order to amend the tract into the Cordero Rojo Mine permit area (section 3.5.1.3).

As mining progresses, the extent of drawdown in the Wyodak coal's groundwater level elevations will depend on variations in hydrologic properties of the coal seam aquifer, the time the pits are open, the distance from mining and dewatering that has occurred because of previous mining, and to a greater extent, CBNG development. Continued drawdown effects from CBNG withdrawals will be likely; therefore, future drawdown to the Wyodak coal aquifer from mining the approved leases and the Maysdorf II LBA tract would be negligible due to the fact that the coal seam has essentially been dewatered. Groundwater elevation data collected by the Cordero Rojo Mine since 1974 have formed the basis for quantifying groundwater level drawdowns since mining began and provide a reasonable and

reliable means to predict trends in groundwater elevations associated with dewatering due to future mining. These data will continue to be recorded according to the mine's WDEQ-approved groundwater monitoring program and included in the annual progress report that the Cordero Rojo Mine submits to the WDEQ/LQD, as well as the GAGMO annual reports.

A "no-coal" zone that exists in the southwest corner of the LBA tract, in sections 4 and 5, T.46N., R.71W., appears to be a paleochannel that is comprised of non-indurated sand overlying fractured siltstone and claystone sequences (section 3.3). This no-coal zone will not be significantly disturbed by mining operations; therefore, the hydrogeologic functions of this potential aquifer will not be disrupted if the Cordero Rojo Mine acquires the Maysdorf II LBA tract.

The subcoal aquifers (Tullock Member of the Fort Union Formation and Lance Formation-Fox Hills Sandstone) are not removed or disturbed by mining, so they are not directly impacted by coal mining activity. The Cordero Rojo Mine has five water supply wells completed in aquifers below the Wyodak coal. If the applicant leases the Maysdorf II tract, water would be produced from these wells for a longer period, but CRM would not require additional sub-coal wells to mine the LBA tract.

It is early in the process of full reclamation and to date, the backfilled materials have not reached an adequate saturated thickness to be aquifer tested at the Cordero Rojo Mine. Therefore, no site-specific data are available for the hydraulic properties of the applicant mine's backfill. The composition of backfill material at the adjacent Belle Ayr Mine is quite similar to that of the Cordero Rojo Mine, and the hydraulic properties of the backfill at both mines, as well as the Maysdorf II LBA tract, are also expected to be quite similar. Permeability values measured in existing monitoring wells completed in the saturated backfill at the Belle Ayr Mine range from 0.002 to 0.78 ft/day (FCW 2003), which is comparable but slightly lower than the reported hydraulic conductivity values determined from most tests of the overburden and Wyodak coal seam within the Cordero Rojo Mine area. These data provide an indication that the Cordero Rojo Mine backfill will readily resaturate as postmining potentiometric elevations recover in the surrounding undisturbed aquifers, and that wells completed in the backfill (including in the Maysdorf II LBA tract) would be capable of supplying sufficient yields to wells constructed for livestock watering uses.

Groundwater quality within the backfill at the Maysdorf II LBA tract would be expected to be similar to groundwater quality measured in existing wells completed in the backfill at Cordero Rojo Mine. To date, nine wells have been installed to monitor water levels and water quality in the backfill at Cordero Rojo Mine. Based on the sampling results of six of these wells beginning as early as 1982 and extending through spring 2004, average TDS concentrations have ranged from about 1,600 mg/L to 6,200 mg/L. TDS concentrations in two of the six wells have consistently exceeded 5,000 mg/L, but they have consistently

remained below this value in the remaining four wells. The TDS concentration in one of the six wells has consistently remained below 2,000 mg/L. The average TDS concentration in the entire six-well database was 3,803 mg/L.

TDS concentrations observed in the Cordero Rojo Mine backfill monitoring wells to date are similar to those found in the undisturbed Wasatch Formation overburden but typically larger than those found in the Wyodak coal aquifer. Postmining groundwater quality is expected to improve after one pore volume of water moves through the backfill. In general, the mine backfill groundwater TDS can be expected to range from less than 2,000 mg/L to about 6,000 mg/L, similar to the premining Wasatch Formation aquifer, and meet Wyoming Class III standards for use as stock water.

3.5.1.2.2 No Action Alternative

Under the No Action alternative for each of these four LBA tracts, the coal lease application for that tract would be rejected, the area included in that tract would not be offered for lease, and coal removal would not occur on that tract at this time. Impacts to groundwater resources related to existing approved mining and CBNG development would continue as permitted on the existing applicant mine leases. Mining operations would not be extended onto portions of these LBA tracts that will not be affected under the currently approved mining and reclamation plans.

As discussed in section 2.2, a decision to reject one or more of these four lease applications at this time would not preclude an application to lease that respective tract in the future.

3.5.1.3 Regulatory Compliance, Mitigation, and Monitoring

In order to obtain a mining and reclamation permit, the Surface Mine Control and Reclamation Act (SMCRA) and state law require surface coal mine operators to evaluate regional and site-specific baseline hydrogeologic environments within and around their mines. Prior to the cumulative drawdown effects of CBNG development and mining on the Wyodak coal seam aquifer, WDEQ required each mine to use a numeric groundwater flow model to predict the extent of water level drawdown that would occur from mining its existing leases. Current mine permit requirements state that future drawdown impacts from mining alone be addressed, although less rigorous methods such as historical groundwater level trend analyses and simple analytical models (i.e., line-sink analysis) can be used rather than more complex models. Results of these studies are included in the WDEQ/LQD mine permits for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines (FCW 2003, TBCC 2006, CCC 2003, and CMC 2007a). These studies would be revised accordingly and included in the mine permit amendment that would be required for each respective LBA tract that is leased. Permit

revisions must be approved before mining could occur on each tract that is leased, regardless of who acquires the tract.

As discussed in section 3.5.3.3, SMCRA and Wyoming regulations require mine operators to provide the owner of a water right whose water source is interrupted, discontinued, or diminished by mining with water of equivalent quantity and quality.

The surface coal mines are also required to monitor water levels and water quality in the overburden, coal, interburden, underburden, and backfill. Operational groundwater monitoring programs are dynamic and modified through time as wells are removed by mining, discontinued from monitoring to eliminate redundancy, or added to replace those removed by mining and to facilitate monitoring of future mine expansion areas as mining has progressed. Additional wells have also been installed in the reclaimed backfill to monitor recovering, postmine groundwater conditions. Many groundwater monitoring wells installed by Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines within and around their current permit areas have been used to evaluate groundwater conditions in the general South Gillette analysis area since the early 1970s and continue to be monitored to reveal a long-term record of groundwater conditions. Wells for which monitoring has been discontinued are still in place and may be reincorporated into the monitoring network in the future.

SMCRA and state regulations require surface coal mines to maintain the essential hydrologic functions of drainages declared AVFs not significant to farming and their alluvial groundwater systems that are disturbed by mining. In order to meet this requirement, the mines are typically required to salvage and stockpile the stream laid alluvial materials during mining and replace them upon final reclamation.

3.5.2 Surface Water

3.5.2.1 Affected Environment

The Belle Fourche River and its tributaries drain the general South Gillette analysis area. For the purpose of this analysis, the area encompasses the four applicant mines (often referred to collectively as the middle PRB mines), the four LBA tracts that are proposed for leasing, the BLM study areas for these four LBA tracts, and the adjacent lands that would disturbed by mining the BLM study areas. From north to south, the analysis area is drained by Tisdale Creek, Duck Nest Creek, Caballo Creek, Coal Creek, and the Belle Fourche River. Tisdale Creek and Duck Nest Creek are tributaries of Caballo Creek, and Caballo Creek and Coal Creek are tributaries of the Belle Fourche River (figure 3-24). The general South Gillette analysis area lies within the mid-eastern part of the Powder River Structural Basin and within the Belle Fourche River drainage basin

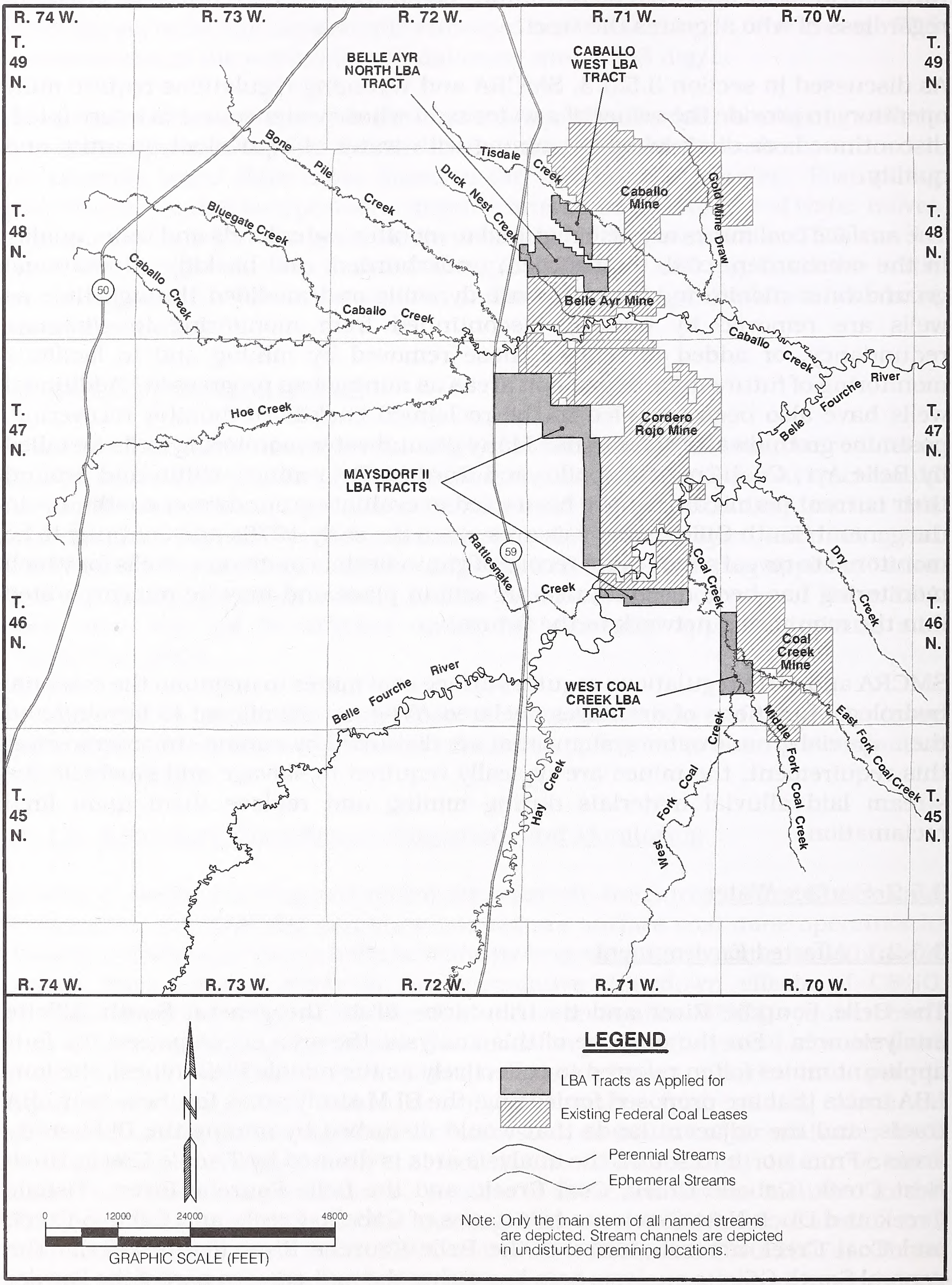


Figure 3-24. Surface Drainage in the General South Gillette Analysis Area.

(Hydrologic Unit Code [HUC] 101202), a tributary of the larger Cheyenne River drainage basin.

The Belle Ayr North analysis area and the existing Belle Ayr Mine permit area are located in the Caballo Creek watershed. The Belle Ayr Mine disturbs Caballo Creek and several of its tributaries, and is currently permitted to disturb approximately 7 percent of the Caballo Creek watershed. A large portion of the Belle Ayr North LBA tract is within the mine's existing permit area. Duck Nest Creek, a southeasterly-flowing ephemeral tributary of Caballo Creek, drains the southern and western portions of the Belle Ayr North general analysis area. Two small, first order tributaries of Caballo Creek and two internally-drained playas drain the remainder of the analysis area.

Coal Creek and its three main branches, East Fork, Middle Fork, and West Fork, drain the West Coal Creek general analysis area and the existing Coal Creek Mine permit area. Typical of this semi-arid area, Coal Creek and its tributaries are all ephemeral streams. No playas or internally-drained topographic depressions have been identified within the analysis area.

The Caballo West analysis area and the existing Caballo Mine permit area are located in the Caballo Creek watershed. The Caballo Mine is permitted to disturb approximately 12 percent of the Caballo Creek watershed. The mine's existing permit area is located primarily within the Tisdale Creek drainage. There are also approximately 2,220 acres of area within the existing Caballo Mine permit area that drain internally toward playas formed by natural topographic depressions. A large portion of the Caballo West general analysis area is within the mine's existing permit area. Tisdale Creek, a southeasterly-flowing ephemeral tributary of Caballo Creek, drains the northern and eastern portions of the analysis area, and a large playa drains the southern and western portions. This same playa also drains the northern portion of the adjacent Belle Ayr North LBA tract.

The Belle Fourche River and its tributaries drain the existing Cordero Rojo Mine permit area and the Maysdorf II general analysis area. The Belle Fourche River flows east-northeasterly through the southern portion of the LBA tract. The central and southern portions of the Maysdorf II general analysis area are drained by several first order tributaries of the Belle Fourche River, while the northern portion is drained by a few first order tributaries that flow north to Caballo Creek. Two areas on and contiguous to the central portion of the analysis area do not contribute runoff to any stream and playas have formed in the lowest portions of these non-contributing drainage basins.

As mentioned above, Tisdale Creek, Duck Nest Creek, and Coal Creek are ephemeral streams that flow only in response to rainfall or snowmelt runoff. Caballo Creek and Belle Fourche River demonstrate characteristics of both an ephemeral and intermittent stream. Streamflow monitoring stations have been operated by the U.S. Geological Survey (USGS) and the applicant mines on these

streams in the analysis area since the mid-1970s. Some stream segments flow only in response to snowmelt runoff in the spring and thunderstorm runoff in the summer months, although there are some stream segments that flow throughout the year in response to alluvial groundwater discharge. Currently, and for some indefinite time into the future, CBNG discharge water is adding flow to Caballo Creek and Belle Fourche River. Streamflow is still very much a function of the amount and timing of precipitation and snowmelt runoff; however, since 1999, the PRB of northeastern Wyoming has experienced extreme drought conditions. Therefore, the mean annual streamflow rate and annual discharge volume has not significantly increased in these streams as a result of the discharge of CBNG-produced waters into surface drainages west of and upstream of the applicant mine, although extended periods of no flow are less common.

Water quality in each of these streams depends highly on flow. Dissolved solids concentrations and specific conductance have an inverse relationship with streamflow; thus, the highest concentrations occur during low flows and lowest concentrations occur during high flows. Total suspended solids (TSS) show a direct relationship with streamflow; TSS concentrations are typically high during high flow and low during low flows. Because vegetative cover is sparse and surface water runoff occurs infrequently in this semi-arid environment, high TSS concentrations can be expected, especially from floods caused by thunderstorms.

The Coal Creek drainage basin, in particular, has been identified as a significant source of sediment to the Belle Fourche River. The Coal Creek drainage is highly dissected and slopes are relatively steep, so combined with the occurrence of erodible soils, the sediment yields are greater than those in upland areas of the Belle Fourche River drainage basin (Ogle et al. 2004).

Surface water monitoring programs required by WDEQ/LQD are included in the four applicant mines' permits. This ensures that streamflows are measured and water quality samples are collected regularly from Tisdale Creek, Duck Nest Creek, Caballo Creek, Coal Creek, and Belle Fourche River at locations upstream and downstream of the respective mines. Comprehensive flow and water quality records are submitted to the WDEQ/LQD in the mines' existing permits and annual reports that are on file and available for public review at WDEQ's offices in Cheyenne and Sheridan, Wyoming.

The USGS conducted a study from 2000 too 2005 within an area of CBNG development in the PRB to characterize the water quality of streams and assess change through time. That study concluded that annual runoff in all major drainage basins was less than average during 2001-2005 due to drought conditions. Water-quality characteristics were highly variable because of streamflow variability, geologic controls, and potential land-use effects. No significant trends in water quality were determined for sites in the Belle Fourche River drainage basin; however, drought conditions during the study period may

not represent long-term water quality conditions for all sites studied (Clark and Mason 2007).

The Belle Fourche River is listed in the WDEQ/WQD Surface Water Classification List as a Class 2ABww stream that is protected for drinking water, aquatic life (classified as a warm water fishery), recreation, wildlife, agriculture, industry and scenic value. However, the numeric human health criteria for iron and manganese do not apply to Class 2 waters in the Belle Fourche River drainage and the main stem of the river. Tisdale Creek, Duck Nest Creek, Caballo Creek, and Coal Creek are listed as Class 3B streams, which are non-fisheries, but are protected for other aquatic life, recreation, wildlife, agricultural and other uses (WDEQ/WQD 2007).

Springs are uncommon in the general South Gillette analysis area. No springs have been identified within the four LBA tracts' general analysis areas, although seeps created by groundwater discharging from the Wasatch overburden to the overlying Duck Nest Creek alluvium exist at the southern boundary of the Belle Ayr North LBA tract. The seepage rate is insufficient to sustain a base flow in the stream channel and only enough to create a marshy area and a few shallow pools of stagnant water.

A few small in-channel reservoirs used for livestock water are located in the four LBA tracts' general analysis areas. Most of these stock ponds are many decades old and have not been permitted with the Wyoming State Engineer's Office (SEO). The SEO records were searched for surface water rights within a 3-mile radius of the four LBA tracts. They are listed in section 3.5.3 and the supplementary information document for this EIS.

3.5.2.2 Environmental Consequences

3.5.2.2.1 Proposed Action and Alternatives 2 and 3

Changes in surface runoff characteristics and sediment discharges would occur during mining on each of the tracts because of the destruction and reconstruction of drainage channels as mining progresses and the use of sediment control structures to manage discharges of surface water from the mine permit areas. Since the LBA tracts would be mined as extensions of the existing mines under the Proposed Action or action alternatives, there would not be a large increase in the size of the area that is disturbed and not reclaimed at any given time as a result of leasing these tracts. Impacts would be similar for both the Proposed Action and action alternatives to the expected impacts for the current mining operations. Reclamation would be ongoing and concurrent with mining.

The removal of soil and vegetation exposes overburden, which results in a potential for increased sediment production during runoff events. However, both state and federal regulations require all surface water runoff from mined lands be

treated by passing through sediment control structures to meet Wyoming Pollutant Discharge Elimination System (WYPDES) and/or National Pollutant Discharge Elimination System (NPDES) discharge criteria before it is released downstream. Generally, the surface runoff sediment is deposited in ponds or alternative sediment control measures (ASCMs) inside the mine's permit area before the surface runoff water is allowed to leave the permit area and be discharged to receiving streams. While mining is in progress, surface water quality would continue to be protected by directing surface runoff from affected areas to various sediment control structures (sediment ponds, traps, ditches, sumps, and mine pits). Under normal conditions, exceedances of effluent limitations are not expected in the future as mining extends into new drainages and additional sediment control facilities are added. The presence of disturbed areas creates a potential that sediment produced by large storms (i.e., greater than the 10-year, 24-hour storm) could adversely impact areas downstream of the mining operations. This potential for adverse downstream impacts would be extended if the LBA tracts were leased.

The temporary diversion and impoundment of runoff water for sediment control may reduce stream flow volumes and peak flows downstream of the mined lands. Impounded water may be used on the mine site for dust control or lost due to infiltration and evaporation. However, in order to maintain adequate available storage volume in sedimentation ponds, the impounded water is discharged when if meets WPDES criteria. The WDEQ/LQD encourages the use of ASCMs to trap sediment and allow runoff to continue downstream (Ogle and Calle 2006).

Immediately following reclamation, the loss of soil structure would act to increase runoff rates on the LBA tracts. However, the general decrease in average slope in reclaimed areas, as discussed in section 3.2.2, and drainage densities common in reclamation would outweigh the potential for an increase in runoff due to a loss of soil structure. Soil structure would gradually recover over time, and vegetation (after successful reclamation) would provide erosion protection from raindrop impact, retard surface flows, and control runoff at approximately premining levels. All surface drainage from reclaimed areas would be controlled using best management practices (BMPs), such as contour furrows, ponds or small depressions for sediment traps, and vegetation buffers, until the area is sufficiently stable that drainage control is no longer required. Surface water monitoring would continue to evaluate and identify anomalous variations in surface water quantity and quality and ensure that runoff leaving the site meets specific water quality criteria.

Once mining is completed the pits would be backfilled and drainage would be reestablished. Surface water drainages would be designed and reconstructed to approximate the premining drainage basin and channel characteristics. The reclaimed drainageways would be constructed to blend with the existing drainage system above and below the area disturbed by the mining operation, providing a

complete drainage system with surface water flow and quality approximating premining conditions.

The impacts described above for surface water would be similar for the Proposed Action and BLM's preferred tract configurations under Alternative 2 (Alternative 3 for the Maysdorf II LBA tract), as well as for the current mining operations. Direct and indirect impacts to the surface water system resulting from mining the four tracts would add to the cumulative impacts that would occur from mining existing leases. These cumulative impacts are discussed in chapter 4 of this EIS. A description of surface water impacts from leasing and mining each LBA tract under the Proposed Action or Alternative 2, BLM's preferred alternative (Alternative 3 for the Maysdorf II LBA tract) follows.

3.5.2.2.1.1 Belle Ayr North LBA Tract

Because the tract is near the headwater areas of three ephemeral Caballo Creek tributaries (Duck Nest Creek and two small drainages, locally named Draw No. 1 and Draw No. 2), and because much of the tract drains internally to two closed basins, runoff would not be expected to be significant. During mining, hydrologic control would probably consist of allowing runoff to accrue to the mine pit, or to a flood control reservoir, where it would be treated and discharged according to the standards of WDEQ/WQD.

3.5.2.2.1.2 West Coal Creek LBA Tract

The West Coal Creek LBA tract lies at the confluences of the East Fork, Middle Fork, and West Fork of Coal Creek, which are all ephemeral streams. Hydrologic control during mining would probably consist of containing these ephemeral streams in flood control reservoirs, diverting flows around active pits, or allowing runoff to accrue to the mine pit, where it would be treated and discharged according to the standards of WDEQ/WQD.

Coal Creek Mine's existing hydrologic restoration plan includes the construction of 12 permanent impoundments intended to provide replacement water storage for existing surface water rights in the permit area (TBCC 2006). Additional postmining impoundments would be included in the reclamation plan for the LBA tract. Significant changes to the area's overall sediment yield after mining would be less likely due to the capture of sediment within the reconstructed stock ponds.

3.5.2.2.1.3 Caballo West LBA Tract

The Caballo West LBA tract lies near the headwaters of Tisdale Creek, an ephemeral tributary of Caballo Creek. Tisdale Creek drains the northern and eastern portions of the Caballo West general analysis area. A large playa drains the southern and western portions of the analysis area. Therefore, runoff within the tract would not be expected to be significant. During mining, hydrologic control would probably consist of allowing runoff to accrue to the mine pit, or

constructing small flood control reservoirs upstream of the pit where it would be treated and discharged according to the standards of WDEQ/WQD.

3.5.2.2.1.4 Maysdorf II LBA Tract

The Belle Fourche River has been diverted around active pits and mine facilities within the existing Cordero Rojo Mine permit area. During mining of the Maysdorf II LBA tract, hydrologic control would consist of constructing another diversion channel for the river around the open pit area. Because this tract is in the headwaters area of ephemeral Belle Fourche River and Caballo Creek tributaries, and because much of the tract drains internally to closed basins, runoff within the tract would be insignificant. Also, hydrologic control during mining would probably consist of allowing runoff to accrue to the mine pit where it would be treated and discharged according to the standards of the WDEQ/WQD. A need for large flood control reservoirs is not anticipated for the LBA tract.

3.5.2.2.2 No Action Alternative

Under the No Action alternative for each of these four LBA tracts, the coal lease application for that tract would be rejected, the area included in that tract would not be offered for lease, and coal removal and the associated disturbance to Tisdale Creek, Duck Nest Creek, Caballo Creek, Coal Creek, and/or the Belle Fourche River would not occur. The impacts to surface water resources related to existing approved mining and CBNG development, described above, would continue as permitted on the existing mines. Mining operations would not be extended onto portions of these LBA tracts that will not be affected under the currently approved mining and reclamation plans.

As discussed in section 2.2, a decision to reject one or more of these four lease applications at this time would not preclude an application to lease that respective tract in the future.

3.5.2.3 Regulatory Compliance, Mitigation, and Monitoring

In accordance with SMCRA and Wyoming State Statutes, Tisdale Creek, Duck Nest Creek, Caballo Creek, Coal Creek, and Belle Fourche River stream channels would be restored after surface mining operations are completed on the four tracts. Surface water flow, quality, and sediment discharge would approximate premining conditions. The drainages that intersect the applicant mines' permit areas would be reclaimed to exhibit channel geometry characteristics similar to the premining characteristics. Tisdale Creek, Duck Nest Creek, Caballo Creek, Coal Creek, and Belle Fourche River stream channels would be restored in approximately the same location as the natural channel, and its premining hydrologic functions would be restored. Additional discussion can be found in section 3.5.1.3.

Other WDEQ/LQD permit requirements for the existing four mines include constructing sediment control structures to manage discharges of surface water from the mine permit areas; treating all surface runoff from mined lands as necessary to meet effluent standards; and restoring stock ponds, playas, and in-channel impoundments disturbed during mining. These requirements would be extended to include the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts when the respective mine permit is amended to include the tract.

Monitoring requirements for each of the existing applicant mines include a program to assure that sediment ponds would always have adequate space reserved for sediment accumulation and collection of streamflow and water quality data from the above mentioned creeks and the Belle Fourche River. These requirements would be extended to include the LBA tracts when the respective mine permit is amended to include the tract.

3.5.3 Water Rights

3.5.3.1 Affected Environment

The Wyoming SEO administers surface water and groundwater rights in Wyoming. Before developing water resources associated with energy development, water appropriations (either groundwater or surface water) in the PRB were typically for livestock use. Currently, mining companies and CBNG development companies hold the majority of the water rights in the general South Gillette analysis area.

Records of the SEO were searched for groundwater rights within a 3-mile radius of the BLM study area for each LBA tract. This information is required for WDEQ permitting. The results of the most recent searches are provided below for each tract. A more detailed listing of the non-coal mine related groundwater rights within a 3-mile radius of each tract is presented in the supplementary information document for this EIS, which is available on request.

For the Belle Ayr North LBA tract, SEO data indicate that, as of June 28, 2007, there were 1,103 permitted water wells within 3 miles of the tract, of which, 717 are owned by coal mining companies. The other 386 non-coal mine related, permitted water wells, which include 315 wells permitted for uses related to CBNG development, are permitted for the following uses:

- 315 CBNG
- 31 livestock
- 21 domestic
- 11 monitoring
- 5 industrial
- 2 miscellaneous
- 1 irrigation

For the West Coal Creek LBA tract, SEO data indicate that, as of November 16, 2007, there were 284 permitted water wells within 3 miles of the tract, of which, 141 are owned by coal mining companies. The other 143 non-coal mine related, permitted water wells, which include 69 wells permitted for uses related to CBNG development, are permitted for the following uses:

- 50 CBNG and livestock
- 42 livestock
- 17 CBNG
- 11 industrial
- 11 livestock and domestic
- 5 miscellaneous
- 4 domestic
- 1 CBNG and miscellaneous
- 1 miscellaneous, dewatering, and CBNG
- 1 unknown

For the Caballo West LBA tract, SEO data indicate that, as of July 25, 2007, there were 1,382 permitted water wells within 3 miles of the tract, of which, 677 are owned by coal mining companies. The other 705 non-coal mine related, permitted water wells, which include 587 wells permitted for uses related to CBNG development, are permitted for the following uses:

- 282 CBNG
- 260 CBNG and livestock
- 37 livestock
- 36 domestic
- 26 CBNG and miscellaneous
- 19 CBNG, livestock, and miscellaneous
- 18 domestic and livestock
- 8 monitoring
- 7 industrial
- 5 miscellaneous
- 1 domestic, livestock, and miscellaneous
- 1 irrigation
- 1 municipal and miscellaneous
- 1 reservoir supply, industrial, and miscellaneous
- 1 livestock and industrial
- 1 livestock and irrigation
- 1 livestock and miscellaneous

For the Maysdorf II LBA tract, SEO data indicate that, as of May 29, 2007 there were 987 non-coal mine related, permitted water wells within 3 miles of the tract, which include 780 wells permitted for uses related to CBNG development. Those 987 wells are permitted for the following uses:

- 429 CBNG
- 225 livestock and CBNG
- 66 livestock
- 57 livestock, miscellaneous, and CBNG
- 52 miscellaneous and CBNG
- 33 monitoring
- 29 domestic and livestock
- 26 miscellaneous
- 21 industrial
- 21 domestic
- 16 miscellaneous, dewatering, and CBNG
- 2 livestock and miscellaneous
- 2 unknown
- 1 CBNG and reservoir
- 1 dewatering and miscellaneous
- 1 dewatering, reservoir, and industrial
- 1 miscellaneous and domestic
- 1 livestock and industrial
- 1 livestock and irrigation
- 1 livestock, irrigation, and domestic
- 1 temporary, industrial, and drilling

SEO records were searched for surface water rights within a 3-mile radius of the study area for each tract (as applied for and the additional area evaluated by BLM). Like the groundwater rights, this information is also required for WDEQ permitting. The results of the most recent searches are provided below for each tract. A more detailed listing of the non-coal mine related surface water rights is presented in the supplementary information document for this EIS, which is available on request.

For the Belle Ayr North LBA tract, SEO records indicate that as of July 6, 2007, there were 186 permitted surface water rights within the search area, of which coal mining companies own 95. The other 91 non-coal mine related, permitted surface water rights are permitted for the following uses:

- 16 irrigation
- 13 livestock
- 4 irrigation and domestic
- 1 livestock and domestic
- 1 reservoir supply
- 56 not designated

For the West Coal Creek LBA tract, SEO records indicate that as of November 16, 2007, there were 54 permitted surface water rights within the search area, of which coal mining companies own 30. The other 24 non-coal mine related, permitted surface water rights are permitted for the following uses:

- 7 livestock
- 17 not designated

For the Caballo West LBA tract, SEO records indicate that as of July 2, 2007, there were 9 non-coal mine related, permitted surface water rights within the search area. These surface water rights are permitted for the following uses:

- 3 irrigation
- 2 livestock
- 1 temporary and industrial
- 1 reservoir supply
- 1 reservoir supply and irrigation
- 1 reservoir supply, irrigation, and domestic

For the Maysdorf II LBA tract, SEO records indicate that as of May 29, 2007, there were 90 non-coal mine related, permitted surface water rights within the search area. These surface water rights are permitted for the following uses:

- 46 livestock
- 16 irrigation
- 10 irrigation and domestic
- 8 temporary oil production, drilling, and industrial
- 4 livestock and domestic
- 3 temporary industrial
- 1 livestock and irrigation
- 1 reservoir supply and domestic
- 1 livestock and fisheries

3.5.3.2 Environmental Consequences

3.5.3.2.1 Proposed Action and Alternatives 2 and 3

As discussed above, there have already been significant drawdowns in the coal and overlying aquifers (where present) because of the past and existing mining activities and CBNG development in the general South Gillette analysis area. As a result, private water supply wells listed in section 3.5.3.1 have already been impacted. Continued effects from groundwater withdrawals associated with CBNG development activities will be likely. Future drawdown to the Wyodak coal aquifer resulting from mining the approved coal leases should be negligible because the coal seam has essentially been dewatered. Therefore, it is unlikely that any of these privately permitted water wells would be indirectly impacted by water level drawdown to a greater extent than current conditions; however, private wells may be physically removed by activities associated with mining the proposed LBA tracts.

Only a slight reduction in streamflow downstream of the applicant mines during mining is expected because runoff will be contained from the disturbed areas by mine pits and other control structures. Downstream surface water rights would be protected by minimizing detention of surface runoff for sediment control and maintaining unrestricted flow in Caballo Creek and Belle Fourche River. Changes to the overall flow and water quality of these streams during mining should be negligible. Any surface water rights listed in section 3.5.3.1 that are located within the proposed mining disturbance areas would be interrupted until the disturbance area is reclaimed.

3.5.3.2.1.1 Belle Ayr North LBA Tract

In June 2007, Wyoming SEO records indicated that 1,103 permitted water wells were located within 3 miles of the Belle Ayr North LBA tract. Approximately 65 percent (717) of these wells are owned by coal mining companies and are used for groundwater monitoring and water supply. Approximately 82 percent of the remaining 386 non-coal mine related wells are permitted for uses related to CBNG development; 8 percent are permitted for livestock use; 5 percent are permitted for domestic use; 3 percent are permitted for monitoring uses; 1 percent are permitted for industrial uses; and about 1 percent are permitted for miscellaneous and irrigation uses.

Some of these privately permitted water wells have been or will likely be impacted (either by removing the well or by water level drawdown) by mining and CBNG development. Future drawdowns to the Wyodak coal aquifer are expected to be negligible because the coal seam has essentially been dewatered. Therefore, it is unlikely that any of these privately permitted water wells would be impacted by water level drawdown to a greater extent than they currently are if this tract is leased and mined.

3.5.3.2.1.2 West Coal Creek LBA Tract

In November 2007, Wyoming SEO records indicated that 284 permitted water wells were located within 3 miles of the West Coal Creek LBA tract. Nearly 50 percent of these wells are owned by coal mining companies and are used for groundwater monitoring and water supply. Approximately 48 percent of the remaining 143 non-coal mine related wells are permitted for some form of CBNG development. Of the 143 non-coal wells, approximately 44 percent are permitted either for multiple uses; 29 percent are permitted either for livestock use only; 12 percent are permitted for CBNG development only; 8 percent are permitted for industrial uses; 4 percent are permitted for miscellaneous uses; 3 percent are permitted for domestic use; and less than1 percent had unknown uses.

Some of these privately permitted water wells have been or will likely be impacted (either by removing the well or by water level drawdown) by mining and CBNG development. Future drawdowns to the Wyodak coal aquifer are expected to be

negligible because the coal seam has essentially been dewatered. Therefore, it is unlikely that any of these privately permitted water wells would be impacted by water level drawdown to a greater extent than they currently are if this tract is leased and mined.

3.5.3.2.1.3 Caballo West LBA Tract

In July 2007, Wyoming SEO records indicated that 1,382 permitted water wells were located within 3 miles of the Caballo West LBA tract. As discussed above, 677, or approximately 49 percent of these wells are owned by coal mining companies and are used for groundwater monitoring and water supply. Approximately 83 percent of the remaining 705 non-coal mine related wells are permitted for some form of CBNG development. Of the 705 non-coal wells, approximately 47 percent are permitted for multiple uses; 40 percent are permitted either for CBNG development only; 5 percent are permitted either for livestock use only; 5 percent are permitted for domestic use only; 1 percent are permitted for monitoring; 1 percent are permitted for industrial use; and about 1 percent are permitted for miscellaneous and irrigation uses.

Some of these privately permitted water wells have been or will likely be impacted (either by removing the well or by water level drawdown) by mining and CBNG development. Future drawdowns to the Wyodak coal aquifer are expected to be negligible because the coal seam has essentially been dewatered. Therefore, it is unlikely that any of these privately permitted water wells would be impacted by water level drawdown to a greater extent than they currently are if this tract is leased and mined.

3.5.3.2.1.4 Maysdorf II LBA Tract

In May 2007, Wyoming SEO records indicated that there were 987 non-coal mine related, permitted water wells within 3 miles of the Maysdorf II LBA tract. Approximately 79 percent of the remaining 987 non-coal wells are permitted for some form of CBNG development. Of the 987 non-coal wells, approximately 43 percent are permitted for CBNG development only; 39 percent are permitted for multiple uses; 7 percent are permitted either for livestock use only; 3 percent are non-coal monitoring wells; 3 percent are permitted for miscellaneous use only; 2 percent are permitted either for domestic uses only; 2 percent are permitted for industrial uses; and less than 1 percent have unknown uses.

Some of these privately permitted water wells have been or will likely be impacted (either by removing the well or by water level drawdown) by mining and CBNG development. Future drawdowns to the Wyodak coal aquifer are expected to be negligible because the coal seam has essentially been dewatered. Therefore, it is unlikely that any of these privately permitted water wells would be impacted by water level drawdown to a greater extent than they currently are if the tract is leased and mined.

3.5.3.2.2 No Action Alternative

Under the No Action alternative for each of these four LBA tracts, the coal lease application for that tract would be rejected, the area included in that tract would not be offered for lease, and coal removal would not occur on that tract at this time. The impacts to water rights associated with existing approved mining and CBNG development, described above, would continue to occur. Mining operations would not be extended onto portions of these LBA tracts that will not be affected under the currently approved mining and reclamation plans.

As discussed in section 2.2, a decision to reject one or more of these four lease applications at this time would not preclude an application to lease that respective tract in the future.

3.5.3.3 Regulatory Compliance, Mitigation and Monitoring

SMCRA and Wyoming regulations require mine operators to provide the owner of a water right whose water source is interrupted, discontinued, or diminished by mining with water of equivalent quantity and quality. This required mitigation is considered part of the action alternatives. The most probable source of replacement water would be one of the aquifers underlying the coal. For example, the subcoal Fort Union Formation aquifers are not removed or disturbed by coal mining and would be a potential source of replacement water.

If the Belle Ayr North, West Coal Creek, Caballo West, and/or Maysdorf II LBA tracts are leased, the mine operator would be required to update the list of potentially impacted private water supply wells and predict impacts to those wells within the 5-foot drawdown contour as part of the permitting process. The operator would be required to replace those water supplies affected by mining with water of equivalent quality and quantity.

3.5.4 Residual Impacts

The area of coal and overburden removal and replacement of overburden and associated groundwater drawdowns would be increased under the action alternatives when compared with the same areas for each of the four existing applicant mines. The postmining backfill may take over 100 years to reach equilibrium water levels and water quality. Less time would be required near the mining boundaries. Monitoring data from wells completed in existing backfilled areas in the PRB suggest that an adequate quantity of water in the backfill to replace current use, which is for livestock. Water quality in the backfill would be expected to meet the Wyoming Class III standards for use as stock water.

3.6 Alluvial Valley Floors

3.6.1 Affected Environment

WDEQ regulations define alluvial valley floors (AVFs) as unconsolidated stream laid deposits where water availability is sufficient for subirrigation or flood irrigation agricultural activities. Guidelines established by OSM and WDEQ/LQD for the identification of AVFs require detailed studies of geomorphology, soils, hydrology, vegetation, and land use. These studies are used to identify 1) the presence of unconsolidated stream laid deposits, 2) the possibility for artificial flood irrigation, 3) past and/or present flood irrigation, and 4) apparent subirrigated areas and the possibility for natural flood irrigation. Following these studies, areas passing the limiting criteria that are identified as AVFs are evaluated for their significance to farming by WDEQ/LQD.

SMCRA prohibits surface coal mining operations that would interrupt, discontinue, or preclude farming on AVFs or cause material damage to the quantity or quality of water systems that supply AVFs. However, if the premining land use of the affected AVF is undeveloped rangeland that is not significant to farming or if the affected AVF is so small that it would have a negligible impact on a farm's agricultural production, these prohibitions would not apply and mining would be allowed. The prohibitions also apply if AVFs that are downstream of the area proposed for mining would be affected by disruptions in streamflow. Provided WDEQ determines that an AVF is not significant to agriculture, it can be disturbed by mining but must be restored as part of the reclamation process. For any designated AVF, regardless of its significance to agriculture, it must be demonstrated that the essential hydrologic functions of the AVF, both within and outside the mine area, will be protected.

In a decision by the U.S. District Court for the District of Columbia, Civil Action Number 69-1144 (1980) (known as the Flannery Decision), the court noted that an AVF must satisfy both geologic criteria (unconsolidated stream laid deposits) and hydrologic criteria (water sufficient to sustain agriculture). Therefore, the court emphasized that the key to the existence of an AVF is the presence of both geologic and water availability characteristics, which together sustain agricultural activities.

FCW, TBCC, CCC, and CRM have conducted investigations to determine the presence of AVFs within and surrounding the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines, respectively. AVF investigations conducted within the general South Gillette analysis area have identified an AVF that occurs along Duck Nest Creek on the Belle Ayr North LBA tract. AVFs have also been identified along Tisdale and Caballo creeks; however, those lands are located at considerable distances downstream of any of the LBA tracts. Figure 3-24 provides information on the location of the major streams with respect to the applicant mines and LBA tracts in the general South Gillette analysis area.

3.6.1.1 Belle Ayr North LBA Tract

Duck Nest Creek, a southeast-flowing ephemeral tributary of Caballo Creek, drains the western portion of the Belle Ayr North LBA tract. Two smaller, unnamed ephemeral tributaries of Caballo Creek and three playas formed by natural topographic depressions drain the balance of the LBA tract. Those portions of Caballo Creek and its tributaries that lie within Belle Ayr Mine's existing permit area have been investigated for the presence of AVFs. A large portion of the BLM study area for this tract is within the mine's existing permit area; therefore, the entire reach of Duck Nest Creek within the BLM study area has been investigated for the presence of an AVF. The small unnamed ephemeral tributaries of Caballo Creek that also drain the LBA tract are almost completely within the mine's existing permit area, but they were not investigated for the presence of an AVF because no streamlaid deposits were found along those drainages.

The Belle Ayr Mine conducted AVF studies along the reach of Duck Nest Creek that is located within and adjacent to the tract in 1986 and 1987. These studies were combined into a comprehensive AVF assessment in 1991 (WWC 1992), which was part of the WDEQ mine permitting process for recovering coal in Belle Ayr Mine's existing federal leases that are located in the western portion of the mine's current permit area. The AVF assessment was referred to as the Duck Nest Tracts or Duck Nest Amendment Area AVF Study. Drainages within that study area included Caballo Creek, Bone Pile Creek, and Duck Nest Creek. Based on the original (1980) AVF study for the Belle Ayr Mine, WDEQ made a determination that the portions of Caballo, Bone Pile, and Duck Nest creeks located in the Duck Nest Amendment Area are not significant to farming (WDEQ/LQD 1988). Following the submittal of the 1991 AVF assessment to the WDEQ, approximately 24.3 acres of AVF on Duck Nest Creek were formally declared within the Duck Nest Amendment Area AVF study area. Approximately 14.9 acres of that total declared acreage on Duck Nest Creek are located within the Belle Ayr North general analysis area.

3.6.1.2 West Coal Creek LBA Tract

Coal Creek and its associated ephemeral tributaries within the existing Coal Creek Mine permit area, including a portion of the BLM study area for the West Coal Creek LBA tract, have been evaluated for the presence of AVFs. Appendix D-11 in Coal Creek Mine's approved mine permit (TBCC 2006) contains the AVF assessment for lands included within the current mine permit boundary. WDEQ/LQD determined that the AVF characteristics of Coal Creek are negligible and it does not meet the regulatory definition of an AVF because the stream laid deposits are limited in extent and not capable of supporting subirrigation or flood irrigation agricultural activities (WDEQ/LQD 2005b). Coal Creek's narrow valley and terrain limitations reduce areas that could support agricultural activities. Surface water quantity is insufficient to support natural or artificial flood

irrigation practices, and historic flood irrigation attempts have not been identified along Coal Creek. Due to its limited areal extent, limited saturated thickness, and low hydraulic conductivity, Coal Creek alluvium does not consistently produce enough water to be put to beneficial use. In addition, based on TDS concentrations, Coal Creek alluvial groundwater generally meets the WDEQ/WQD standards for livestock use. However, the quality is variable from well to well and at some locations it may exceed the livestock standard and at other locations it may be suitable for both livestock and agricultural use (WDEQ/LQD 2008).

If the West Coal Creek LBA tract is leased and proposed for mining, an AVF assessment would be part of the mine permitting process, and formal declarations of the presence or absence of an AVF, its significance to agriculture, and the appropriate perimeter (areal extent) would be made by the WDEQ/LQD as part of the permitting process. Based on previous non-AVF declarations made on Coal Creek within and adjacent to the existing Coal Creek Mine permit area, including a portion of the BLM study area for the tract, some preliminary investigations that have been made by TBCC, and based on the lack of site-specific AVF determination factors, it is unlikely that the WDEQ/LQD would declare an AVF is present on the LBA tract that lies outside of Coal Creek Mine's existing permit boundary. Final AVF determinations will be made by the WDEQ/LQD based on data, mapping, site visits and analysis of site-specific conditions.

<u>3.6.1.3 Caballo West LBA Tract</u>

Tisdale Creek and its associated ephemeral tributaries within the existing Caballo Mine permit area, including a portion of the BLM study area for this tract, have been investigated for the presence of AVFs by the Caballo Mine. Appendix D-11 in Caballo Mine's approved mine permit (CCC 2003) contains the AVF assessment for lands included within the current mine permit boundary. The only portion of Tisdale Creek determined to be an AVF is at the stream's confluence with Gold Mine Draw, which is located approximately 4 miles downstream and to the southeast of the Caballo West general analysis area. Within section 13, T.48N., R.71W., Gold Mine Draw was declared by WDEQ/LQD to be an AVF significant to agriculture. A tributary of Tisdale Creek, known locally as North Tisdale Creek, is located east and north of this tract, and it too has received a negative AVF declaration from WDEQ/LQD (2004).

The Caballo Mine submitted an AVF predetermination document to the WDEQ/LQD for lands within a proposed permit amendment area, including that portion of the Caballo West general analysis area that is outside of the existing permit boundary. No streams that have AVF characteristics are located within ½ mile of the proposed permit amendment area because the streams are incised and contain few stream laid deposits. In addition, there are no present or historical records of agricultural use, other than undeveloped range land, of the stream channels and associated stream laid deposits within the proposed permit amendment area. Based on previous non-AVF declarations made on Tisdale

Creek within and adjacent to this tract and based on the lack of site-specific AVF determination factors, it is unlikely that the WDEQ/LQD would declare that an AVF is present on the LBA tract that lies outside of Caballo Mine's existing permit boundary where the drainages are smaller and AVF characteristics are negligible. Final AVF determinations will be made by the WDEQ/LQD based on data, mapping, site visits and analysis of site specific conditions.

3.6.1.4 Maysdorf II LBA Tract

Portions of the Belle Fourche River and its associated ephemeral tributaries within and adjacent to the existing Cordero Rojo Mine permit boundary, and portions of Caballo Creek within and adjacent to the existing Belle Ayr Mine permit boundary (north of the Maysdorf II LBA tract), have been investigated for the presence of AVFs (CMC 2007a and FCW 2003).

Three separate areas along Caballo Creek, located within and upstream of the existing Belle Ayr Mine permit boundary and north of the LBA tract, were studied by FCW and determined by WDEQ/LQD to be AVFs (FCW 2003). One of these areas (located in sections 35 and 36, T.48N., R.71W.) was determined to be an AVF with possible significance to agriculture. The second area along Caballo Creek (located in sections 32 and 33, T.48N., R.71W. and section 5, T.47N., R.71W.) was determined to be an AVF not significant to agriculture. The third AVF study was conducted in 1996 by the Belle Ayr Mine to determine the presence of AVFs west of that mine's original AVF study area. As a result of that study, WDEQ/LQD determined an area along Caballo Creek (located in section 31, T.48N., R.71W., section 36, T.48N., R.72W., and section 1, T.47N., R.72W.) to be an AVF that is not significant to farming. The declared AVF located in section 1, T.47N., R.72W. is within the Maysdorf II general analysis area.

Several AVF studies have been conducted on the Belle Fourche River and its associated ephemeral tributaries within and adjacent to the existing Cordero Rojo Mine permit boundary. WDEQ/LQD has determined that the Belle Fourche River valley in the vicinity of the Cordero Rojo Mine is not an AVF because it is incapable of supporting subirrigation or flood irrigation agricultural activities, and that all lands within the existing permit area are considered undeveloped rangeland (CMC 2007a). The Belle Fourche River is considered an impractical water source for artificial flood irrigation practices due to poor water quality and infrequent water availability. Historic flood irrigation attempts have not been identified along the Belle Fourche River or its ephemeral tributaries within and adjacent to the existing Cordero Rojo Mine permit area. CRM's baseline studies also determined that there is a small amount of groundwater in storage in the unconsolidated deposits of the Belle Fourche River, with subirrigation confined to a narrow area immediately adjacent to the channel (CMC 2007a).

The most recent AVF study along the Belle Fourche River was completed by CRM in 2007 as part of a mine permit amendment process. The study area included

approximately 7.4 miles of the river upstream of the existing permit boundary through sections 9 and 16, T.46N., R.71W., which includes the southern portion of the Maysdorf II analysis area. The WDEQ/LQD can make a formal declaration of the presence or absence of an AVF, its significance to agriculture, and the appropriate areal extent as part of the mine permitting process, if the LBA tract is leased and proposed for mining. WDEQ/LQD Coal Rules and Regulations also allow for a pre-determination of the presence or absence of an alluvial valley floor (WDEQ/LQD 2001). WDEQ/LQD has determined that there are no AVFs within the 7.4 mile section of the Belle Fourche River described above (WDEQ/LQD 2007).

3.6.2 Environmental Consequences

3.6.2.1 Proposed Action and Alternatives 2 and 3

AVF investigations conducted within the general South Gillette analysis area have identified an AVF that occurs along Duck Nest Creek on the Belle Ayr North LBA tract. AVFs have also been identified along Tisdale and Caballo creeks; however, those lands are located downstream of the LBA tracts.

If the Belle Ayr North LBA tract is mined by the applicant as an extension of the existing Belle Ayr Mine operations under the Proposed Action or Alternative 2, BLM's preferred tract configuration, the mining operations would affect approximately 14.9 acres of declared AVF along Duck Nest Creek. Mining activity would not be restricted in the AVF areas because the WDEQ/LQD has declared them not to be significant to farming (WDEQ/LQD 1988). The entire reach of Duck Nest Creek downstream of the LBA tract has been affected by previous and current mining operations at the Belle Ayr Mine.

AVF investigations conducted within and adjacent to the existing Coal Creek Mine permit area have determined that the AVF characteristics of Coal Creek and its associated ephemeral tributaries (West, Middle, and East forks) are negligible and do not meet the regulatory definition of an AVF (WDEQ/LQD 2005b). As indicated above, the entire West Coal Creek general analysis area has not yet been formally evaluated for the presence of AVFs, but the general absence of flood and subirrigation activity in this area indicates it is unlikely that mining the tract by the applicant as an extension of the existing Coal Creek Mine would be precluded by the presence of an AVF. Final AVF determinations will be made by the WDEQ/LQD based on data, mapping, site visits and analysis of site-specific conditions.

Based on previous non-AVF declarations made on Tisdale Creek within and adjacent to the Caballo West LBA tract (WDEQ/LQD 2004) and based on the lack of site-specific AVF determination factors, it is unlikely that the WDEQ/LQD would declare an AVF on the tract that lies outside of Caballo Mine's existing permit boundary where the drainages are smaller and AVF characteristics are

negligible. As stated above, the nearest AVF in the vicinity of the tract is approximately 4 miles downstream on Tisdale Creek, and it was declared insignificant to farming. The entire reach of Tisdale Creek downstream of the tract has been affected by previous and current mining operations at the Caballo Mine. It is unlikely that mining the LBA tract under the Proposed Action or Alternative 2 (BLM's preferred tract configuration) would be precluded by the presence of an AVF. Final AVF determinations will be made by the WDEQ/LQD based on data, mapping, site visits and analysis of site-specific conditions.

AVF investigations conducted within and adjacent to the Maysdorf II general analysis area have identified three small AVF areas that occur along Caballo Creek, downstream of the northern portion of the Maysdorf II LBA tract. No AVFs have been identified along the Belle Fourche River and its associated ephemeral draws within and adjacent to the existing Cordero Rojo Mine permit boundary. As indicated above, CRM conducted an AVF assessment in 2007 along the Belle Fourche River upstream of the mine's existing permit boundary and within the southern portion of the Maysdorf II general analysis area. WDEQ/LQD has determined that there are no AVFs within the 7.4-mile section of the Belle Fourche River described above (WDEQ/LQD 2007).

No direct, indirect, or cumulative impacts are anticipated to off-site AVFs from mining the four LBA tracts in the general South Gillette analysis area. Streamflows in the Belle Fourche River would be diverted around the active mining areas in a temporary diversion channel. Consequently, disruptions to streamflow that might supply AVFs on the Belle Fourche River downstream of the Belle Ayr Mine would not be expected to be substantial. Streamflows in the other drainages within the four LBA tracts would be diverted around active mining areas in temporary diversion channels, captured in flood control reservoirs above the pit, or allowed to flow into the mine pit and routed through settling ponds. If flood control impoundments and/or settling ponds are used, it would be necessary to evacuate them following major runoff events to provide storage volume for the next flood. Consequently, disruptions to streamflows that might supply downstream AVFs should be negligible. Groundwater and surface runoff intercepted by the mine pits would be routed through settling ponds as required to meet state and federal quality criteria. The pond discharges would increase the frequency and amount of flow in these streams, thereby increasing surface water supplies to downstream AVFs.

If the LBA tracts are mined as an extension of existing operations, the mining would generally extend upstream on streams already in active mine areas. Therefore, no direct, indirect, or cumulative impacts are anticipated to off-site AVFs through mining of the Belle Ayr North, West Coal Creek, Caballo West, or the Maysdorf II LBA tracts.

3.6.2.2 No Action Alternative

Under the No Action alternative for each of these four LBA tracts, the coal lease application for that tract would be rejected, the area included in that tract would not be offered for lease, and coal removal would not occur on that tract at this time. Impacts to AVFs related to existing mining operations would continue to occur as permitted. Mining operations would not be extended onto portions of these LBA tracts that will not be affected under the currently approved mining and reclamation plans.

As discussed in section 2.2, a decision to reject one or more of these four lease applications at this time would not preclude an application to lease that respective tract in the future.

3.6.3 Regulatory Compliance, Mitigation and Monitoring

SMCRA restricts mining activities that would affect AVFs that are determined to be significant to agriculture and impacts to those lands are not permitted. If the AVF is declared insignificant to agriculture, or if a permit affecting the AVF was issued before SMCRA to effect, the AVF can be disturbed during mining but must be restored as part of the reclamation process. In Wyoming, WDEQ/LQD determinates the significance to agriculture based on specific calculations related to crop production or forage on the AVF and the size of the existing agricultural operations on the land that is part of the AVF. For any designated AVF, regardless of its significance to agriculture, it must be demonstrated that the essential hydrologic functions of the stream valley will be protected. Mines are required to restore the essential hydrologic functions of any affected AVF and preserve the hydrologic functions of AVFs on adjacent lands.

Downstream AVFs must also be protected during mining. The effects of mining on downstream AVFs are required by regulation by monitoring discharges of surface water from the current mine permit areas for quantity and quality during mining. These requirements would be extended and included in the mine permit amendment for each LBA tract if the tract is leased. Mine permit revisions must be approved before mining could occur on each tract that is leased, regardless of who acquires the tract.

3.6.4 Residual Impacts

No residual impacts to AVFs would occur following mining.

3.7 Wetlands

3.7.1 Affected Environment

Wetlands are aquatic features defined as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR 328.3(b)). The prolonged presence of water creates conditions that favor the growth of specially adapted plants and promote the development of characteristic wetland (hydric) soils (EPA 2007c). Vegetation in wetland environments is highly productive and diverse and provides habitat for many wildlife species. These systems as a whole play important roles in controlling floodwaters, recharging groundwater, and filtering pollutants (Niering 1985).

Wetlands must contain three components: hydric soils, a dominance of hydrophytic plants, and wetland hydrology. When the upper part of the soil is saturated with water at growing season temperatures, soil organisms consume the oxygen in the soil and cause conditions unsuitable for most plants. Such conditions also cause the development of soil characteristics (such as color and texture) of so-called "hydric soils". The plants that can grow in such conditions, such as marsh grasses, are called "hydrophytes". Together, hydric soils and hydrophytes give clues that a wetlands area is present. The presence of water by ponding, flooding, or soil saturation is not always a good indicator of wetlands. Except for wetlands flooded by ocean tides, the amount of water present in wetlands fluctuates as a result of rainfall patterns, snow melt, dry seasons and longer droughts.

Waters of the U.S. (WoUS) include all areas subject to regulation by the U.S. Army Corps of Engineers (COE) pursuant to the Clean Water Act (CWA), to include special aquatic sites, of which wetlands is a subset. The definition of WoUS has been broadly interpreted to include most major water bodies, streams, intermittent drainages, mud flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, and natural ponds. Special aquatic sites are defined as "geographic areas, large or small, possessing special ecological characteristics and productivity, habitat, wildlife protection, or other important and easily disrupted ecological values" (40 CFR 230.3[q-1]). Special aquatic sites include "sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes" (40 CFR 230, Subpart E).

Wetlands subject to CWA jurisdiction are known as "jurisdictional wetlands", while those wetlands not subject to CWA jurisdiction are known as "non-jurisdictional" wetlands. Compliance with Section 404 and its implementing regulations requires a sequence of avoidance, minimization of impact, and mitigation of wetlands. Precise definitions of WoUS or navigability are ultimately

dependent on judicial interpretation and cannot be made conclusively by administrative agencies (33 CFR 329). Rules, regulations, policies, and procedures used in determining the extent of jurisdiction have changed and evolved with time. Many ephemeral channels and playas in the PRB have, in the past, been classified as WoUS. However, several changes have occurred to the COE regulatory program over the past several years that will have a bearing on the current status of numerous areas historically classified as jurisdictional. For example, in 2001 the U.S. Supreme Court ruled that isolated waters and playas are not WoUS. A U.S. Supreme Court decision (*Rapanos v. United States* and *Carabell v. United States*, collectively referred to as the "Rapanos" decision) in 2006 attempted to address federal jurisdiction over waters of the U.S. under the CWA (EPA 2007d). According to the Court's decision, the EPA and COE must ensure that jurisdictional determinations, permitting actions, and other relevant actions are consistent with the Rapanos decision. The decision addressed where the federal government can apply the CWA, specifically by determining whether a wetland or tributary is a "Water of the U.S.", being "relatively permanent, standing or continuously flowing bodies of water" connected to traditional navigable waters, and to "wetlands with a continuous surface connection (nexus) to" such relatively permanent waters. As a result of that decision, the COE has placed a moratorium on the issuance of approved jurisdictional determinations that will be in place until the COE headquarters, the EPA, and the Department of Justice determines how to proceed and issues appropriate legal guidance.

Briefly, the agencies will assert jurisdiction over the following waters:

- Traditional navigable waters;
- Wetlands adjacent to traditional navigable waters;
- Non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months); and
- Wetlands that directly abut such tributaries.

The agencies will decide jurisdiction over the following waters based on a fact-specific analysis to determine whether they have a significant nexus (connection) with a traditional navigable water:

- Non-navigable tributaries that are not relatively permanent;
- Wetlands adjacent to non-navigable tributaries that are not relatively permanent; and
- Wetlands adjacent to, but do not directly abut, a relatively permanent non-navigable tributary.

The agencies will generally not assert jurisdiction over the following features:

- Swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow); and

- Ditches (including roadside ditches) excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water.

In describing wetlands, three very different types, from a permitting perspective, may be identified, those being jurisdictional, non-jurisdictional, and functional. Functional wetlands are areas that may contain only one or two of the three wetland criteria (presence of hydric soils, a dominance of hydrophytic plants, and wetland hydrology). The United States Fish and Wildlife Service (USFWS) uses this third categorization in producing National Wetland Inventory (NWI) maps, which are based on aerial photo interpretation with limited or no field verification.

Wetlands occur in a variety of forms and are somewhat limited in size within the general South Gillette analysis area. Riverine wetlands, defined by their close association with perennial and intermittent streams, occur sporadically along drainages. Periodic flooding events can also support Riverine wetlands areas. Common vegetation species in these settings can include willows (*Salix* spp.), scouring rush (*Equisetum* spp.), sedges (*Carex* spp.), and rushes (*Juncus* spp.). Palustrine wetlands, defined by their close association with emergent herbaceous marshes, swales, and wet meadows, support a variety of lush plant life and occur sporadically along major drainages and where topographic depression areas are naturally subirrigated and/or sporadically flooded. Common species in these settings can include sedges, rushes, cordgrass (*Spartina* spp.), mint (*Mentha* spp.), and buttercup (*Ranunculus* spp.). Depressional areas that hold water may support lacustrine wetlands. When natural, these wetland areas are called playas; however, manmade structures such as stock ponds also may support these systems. The most common species in these settings include cattails (*Typha* spp.) and bulrush (*Scirpus* spp.), although lady's thumb (*Polygonum* spp.), verbena (*Verbena* spp.), and milkweed (*Asclepias* spp.) may also occur (USFS 1987).

In addition to wetlands, the general South Gillette analysis area may include jurisdictional other waters of the U.S., as defined by 33 CFR 328.3. These other waters of the U.S. are primarily ephemeral stream channels, open water, and other stream channels that carry water but do not meet the criteria for classification as wetlands.

3.7.1.1 Belle Ayr North LBA Tract

The wetlands analysis area for the Belle Ayr North LBA tract includes the BLM study area for the LBA tract plus a ¼-mile disturbance buffer around the BLM study area sufficient to mine and reclaim the tract as a part of the Belle Ayr Mine operation. A formal wetland delineation has been confirmed by the COE for the portion of the LBA tract wetlands analysis area that is within the adjacent existing Belle Ayr Mine permit area (FCW 2003). A formal wetland survey for the portion of the wetlands analysis area that is outside of the current Belle Ayr Mine permit area has not yet been completed; however, a portion of the large playa located in sections 18 and 19, T.48N., R.71W. and section 13, T.48N., R.72W. is the only

Water of the U.S. within the wetlands analysis area that has not yet had a determination made by the COE.

A total of approximately 193.9 acres of waters of the U.S., including a total of 14.4 acres of jurisdictional waters of the U.S., occur within the wetlands analysis area for the Belle Ayr North LBA tract. Approximately 11.9 of those acres are jurisdictional wetlands that occur along the watercourse of Duck Nest Creek. The 2.5 acres of jurisdictional other waters of the U.S. that did not qualify as jurisdictional wetlands consist primarily of open water that is held within the in-channel impoundments and intermittent pools along Duck Nest Creek. The non-jurisdictional waters of the U.S. contained in the wetlands analysis area consists of the internally drained playas and total approximately 179.5 acres in area. As a result of recent court directives, playas are no longer identified as jurisdictional waters of the U.S. under Section 404 of the CWA (refer to section 3.7.1.3 below). These non-jurisdictional wetland features can however have significant biological and hydrological importance.

<u>3.7.1.2 West Coal Creek LBA Tract</u>

The wetlands analysis area for the West Coal Creek LBA tract includes the BLM study area for the LBA tract plus a ¼-mile disturbance buffer around the BLM study area sufficient to mine and reclaim the tract as a part of the Coal Creek Mine operation. A formal wetland delineation has been confirmed by the COE for the portion of the LBA tract wetlands analysis area that is within the adjacent existing Coal Creek Mine permit area (TBCC 2006). Coal Creek Mine conducted a preliminary wetlands inventory in 2007, based on USFWS NWI mapping and vegetation mapping in the field (BKS 2007a), for the non-delineated portions of the wetlands analysis area. Some wetland areas previously mapped by the USFWS NWI project have been recently altered somewhat due to CBNG-related water production within and upstream of the West Coal Creek wetlands analysis area. The boundaries of the existing potential wetlands may vary to a greater or lesser extent from the boundaries shown on the NWI maps, and current field conditions may not be representative of the field conditions in the future. A formal wetland delineation of the area proposed for mining would be conducted and submitted to the COE for verification as part of the mining and reclamation permit process, if the West Coal Creek LBA tract is leased.

Coal Creek, an ephemeral stream, drains the West Coal Creek wetlands analysis area. No emergent vegetation or hydric soils were identified along the stream channel and its banks within the wetlands analysis area during the vegetation survey conducted in the summer of 2007; however, standing water was present within its banks in many places as a result of recent thunderstorm events. A few in-channel, diked stock ponds are present and NWI mapping identifies them as probable wetlands; however, no palustrine emergent vegetation was found to be supported by these ponds and some were in fact dry. The primary plant species found along the channel and surrounding the stock ponds were *Carex* species

(sedge), *Elymus smithii* (western wheatgrass), *Bromus tectorum* (cheatgrass brome). Occasionally occurring plant species included *Vicia americana* (American vetch), *Eleocharis palustris* (bald spikerush), *Thlaspi arvense* (field pennycress) and *Spartina pectinata* (prairie cordgrass). These stock ponds would be characterized as other waters of the U.S. and they total approximately 3.8 acres in area.

During the 2007 vegetation field mapping, a tributary to West Fork Coal Creek, located in the southwestern portion of section 30, T.46N., R.70W., was found to be receiving CBNG discharge water from upstream of the wetlands analysis area. Approximately 4.2 acres of open water presently occurs within the channel, but wetland characteristics (e.g., hydrophytic wetland vegetation and hydric soils) were not identified.

Based on the existing USFWS NWI mapping data (which may be somewhat outdated), the wetlands confirmed to be present within the adjacent Coal Creek Mine's permit area, and the vegetation mapping that was conducted in 2007, a total of approximately 16.92 acres of wetlands and other waters of the U.S. occur within the West Coal Creek wetlands analysis area. The earlier wetland delineation confirmed by the COE identified a total of approximately 3.48 acres of wetlands, which are associated with the stream channels (both riverine- and palustrine marsh-types), within the wetlands analysis area. The 2007 preliminary wetlands survey identified approximately 13.44 acres of other waters of the U.S., which were areas of open water held within the stream channels, or in-channel impoundments identified by NWI mapping that were found to be dry at the time.

Non-jurisdictional wetlands and other waters of the U.S. were included in the above acreages and were not identified separately because only the COE has the authorization to make such determinations. Non-jurisdictional wetlands are generally associated with internally drained depressions/playas that are isolated, and non-jurisdictional other waters of the U.S. generally occur where areas of open water are ponded in a depression/playa area. No internally drained playas have been identified within the West Coal Creek general analysis area.

3.7.1.3 Caballo West LBA Tract

The wetlands analysis area for the Caballo West LBA tract includes the BLM study area for the LBA tract plus a ¼-mile disturbance buffer around the BLM study area sufficient to mine and reclaim the tract as a part of the Caballo Mine operation. A formal wetland delineation has been confirmed by the COE for the portion of the LBA tract wetlands analysis area that is within the adjacent existing Caballo Mine permit area (CCC 2003). Caballo Mine conducted a preliminary wetlands inventory in 2007, based on USFWS NWI mapping and vegetation mapping in the field, for the non-delineated portions of the wetlands analysis area. A formal wetland delineation survey would be conducted and submitted to the COE for verification as part of the mining and reclamation permit process, if the tract is leased.

Most of the wetlands within the wetlands analysis area are associated with the watercourses of Tisdale Creek and an internally drained playa. Within the portion of the wetlands analysis area that is inside the adjacent existing Caballo Mine permit area, a total of 5.96 acres of jurisdictional wetlands are located along Tisdale Creek. NWI mapping shows small areas (approximately 0.55 acre total) of probable wetlands located in stock ponds or pools along a tributary draw in section 17, T.48N., R.71W., which are outside of Caballo Mine's permit area, and therefore have not been previously confirmed by the COE. Within the wetlands analysis area is approximately 3,964 feet of ephemeral stream channel that is jurisdictional other waters of the U.S.

Therefore, based on preliminary wetlands mapping completed in 2007 and earlier wetland delineation confirmed by the COE, a total of approximately 15.0 acres of waters of the U.S., including a total of 8.63 acres of jurisdictional waters of the U.S., occur within the entire wetlands analysis area. Approximately 6.51 of those acres are jurisdictional wetlands that occur along the water courses of Tisdale Creek. The 2.12 acres of jurisdictional other waters of the U.S. that did not qualify as wetlands consist primarily of open water that is held within the in-channel impoundments along Tisdale Creek.

The playa located near the center of section 7, T.48N., R.71W., adjacent to the LBA tract as applied for and within the wetlands analysis area, was delineated in 1996 as a jurisdictional wetland, but was later declared non-jurisdictional by the COE following a decision of the U.S. Supreme Court in *Solid Waste Agency of Northern Cook County v U.S. Army Corps of Engineers* (No. 99-1178, January 9, 2001). Approximately 6.37 acres of non-jurisdictional wetlands are included in this playa.

3.7.1.4 Maysdorf II LBA Tract

The wetlands analysis area for the Maysdorf II LBA tract includes the BLM study area for the LBA tract plus a ¼-mile disturbance buffer around the BLM study area sufficient to mine and reclaim the tract as a part of the Cordero Rojo Mine operation. Cordero Rojo Mine conducted a preliminary wetlands inventory in 2005 and 2006 of the lands within the wetlands analysis area, based on USFWS NWI mapping and vegetation mapping in the field (ESCO 2007a). The area investigated is located almost entirely outside of the existing Cordero Rojo Mine permit area, west and south of the current permit boundary. Some wetland areas previously mapped by the USFWS NWI project have been recently altered somewhat due to CBNG-related water production within and upstream of the Maysdorf II wetlands analysis area. The boundaries of the existing potential wetlands may vary to a greater or lesser extent from the boundaries shown on the NWI maps, and current field conditions may not be representative of the field conditions in the future. Due to the ephemeral nature of CBNG dewatering activities, the wetland boundaries and areas are likewise ephemeral. A formal wetland delineation survey of the area proposed for mining would be conducted

and submitted to the COE for verification as part of the mining and reclamation permit process, if the LBA tract is leased.

Wetlands occur in a variety of forms within the wetlands analysis area and are generally associated with the watercourses of the Belle Fourche River and Caballo Creek, diked or impounded ponds, and internally drained playas. The wetland areas mapped by USFWS in this area are described as palustrine (marshy) emergent vegetation. These wetlands support a variety of lush plant life and occur along the banks of the Belle Fourche River and Caballo Creek, around a few diked or impounded livestock ponds, and within a few closed depressions. The palustrine wetlands, which are supported by temporarily or seasonally flooded soils, are adequately supplied with surface runoff and/or discharged waters from CBNG production.

The Streamside Bottomland vegetation community, which was mapped in 2005 and 2006 along the banks of the Belle Fourche River and Caballo Creek, is considered wetlands by COE's wetland delineation standards. The well-wetted banks of the Belle Fourche River have, at present, wetland vegetation, soils and hydrology; the latter being somewhat dependant upon the volume of water discharged into the drainage basin from CBNG dewatering activities.

The Streamside Bottomland vegetation community also occurs along Caballo Creek in the wetlands analysis area. Through this reach, the steep banks of Caballo Creek has helped to minimize an increase in the wetted area caused by increased streamflow from CBNG development-related inflow. However, some areas adjacent to the stream have become more extensively moistened and are likely to exceed pre-CBNG development extents. As a result, some portions of these areas may now be considered wetlands (ESCO 2007a). In addition, increased water-borne salt load in Caballo Creek seems to have altered the Streamside Bottomland species composition from what it was in the mid-1990s (ESCO 1996).

Based on the existing USFWS NWI mapping data (which may be somewhat outdated) and the vegetation mapping that was conducted in 2005 and 2006, a total of approximately 140.15 acres of wetlands and other waters of the U.S. occur within the wetlands analysis area. Of this 140.15 acres identified, approximately 133.54 acres are vegetated wetlands and the remaining 6.61 acres are other waters of the U.S. The majority of the wetlands are associated with the watercourses of the Belle Fourche River and Caballo Creek, diked or impounded reservoirs, and internally drained depressions/playas, while the majority of the other waters of the U.S. are associated with ephemeral stream channels and areas of open water.

Non-jurisdictional wetlands and other waters of the U.S. were included in the above acreages and were not identified separately because only the COE has the authorization to make such determinations. Non-jurisdictional wetlands are

generally associated with internally drained depressions/playas that are isolated, and non-jurisdictional other waters of the U.S. generally occur where areas of open water are ponded in a depression/playa area. Approximately 49.94 acres of playas occur in the area, and those internally drained areas would probably be considered non-jurisdictional by the COE.

3.7.2 Environmental Consequences

3.7.2.1 Proposed Action and Alternatives 2 and 3

Formal delineations have been confirmed by the COE for wetland areas and other waters of the U.S. included in the proposed LBA tracts that lie within the four applicant mines' existing permit areas. Based on those previous wetland surveys, NWI mapping by USFWS, and the vegetation mapping in the field that was completed from 2005 to 2007, a maximum of approximately 366 acres of wetlands and other waters of the U.S. would be disturbed if each of the four LBA tracts is leased and subsequently mined under Alternative 2, BLM's preferred alternative (Alternative 3 for the Maysdorf II LBA tract). Formal wetland inventories covering the remainder of the wetlands analysis areas for the LBA tracts that are leased would be conducted and submitted to the COE for verification as part of the process of obtaining a surface coal mining permit. In Wyoming, once the delineation has been verified by the COE, it would be made a part of the mine permit document. The reclamation plan would then be revised to incorporated replacement of at least equal types and number of jurisdictional wetlands.

Disturbed non-jurisdictional wetlands would be restored as required by the authorized federal or state agency or private surface land owner as specified in the mining and reclamation permit, which would have to be approved by WDEQ/LQD before mining operations could be conducted on the LBA tracts that are leased.

During the period of time after mining and before replacement of wetlands, all wetland functions would be lost. The replaced wetlands may not duplicate the exact function and landscape features of the premine wetlands, but replacement plans would be evaluated by the COE and replacement would be in accordance with the requirements of Section 404 of the CWA as determined by the COE.

3.7.2.2 No Action Alternative

Under the No Action alternative for each of these four LBA tracts, the coal lease application for that tract would be rejected, the area included in that tract would not be offered for lease, and coal removal would not occur on that tract at this time. Impacts to wetlands and other waters of the U.S. related to existing approved mining operations would continue to occur as currently permitted. Mining operations would not be extended onto portions of these LBA tracts that will not be affected under the currently approved mining and reclamation plans.

As discussed in section 2.2, a decision to reject one or more of these four lease applications at this time would not preclude an application to lease that respective tract in the future.

3.7.3 Regulatory Compliance, Mitigation and Monitoring

A formal wetland delineation survey must be conducted prior to mining according to approved procedures (COE 1987) and submitted to the COE for verification as to the amounts and types of jurisdictional wetlands and other waters present. Once the delineation has been verified, it is made part of the mine and reclamation permit.

The presence of jurisdictional wetlands and other waters of the U.S. on a mine property do not preclude mining. There are special required permitting procedures to assure that after mining there will be no net loss of wetlands. The COE requires replacement of all impacted jurisdictional wetlands in accordance with Section 404 of the CWA, and all wetland replacement plans have to be approved by the COE. As such, a formal jurisdictional wetland delineation survey would be conducted and submitted to the COE for verification as part of the mining and reclamation permit process for each of these four LBA tracts that are leased and proposed for mining.

Section 404 of the CWA does not cover non-jurisdictional or functional wetlands; however, Executive Order (EO) No. 11990 – Protection of Wetlands (May 24, 1977) – requires that all federal agencies protect all wetlands. Mitigation for impacts to non-jurisdictional wetlands located on these four LBA tracts will be specified during the permitting process as required by the authorized state or federal agency (which may include the WDEQ, OSM, or the federal surface managing agency, if any federal surface is included in the tract) or the private surface owner. Surface land ownership on the general South Gillette analysis area is private and federal (see section 3.11). The federal surface is administered by the USFS. WDEQ/LQD allows and sometimes requires mitigation of non-jurisdictional wetlands affected by mining, depending on the values associated with the wetland features. WDEQ/LQD may also require replacement of sites with hydrologic significance. If any playas with hydrologic significance are located on the tract that is leased, WDEQ/LQD would also require their replacement.

Finally, the surface mining regulatory authorities (WDEQ/LQD and OSM) typically require replacement of non-jurisdictional and functional wetlands as a measure to protect and enhance wildlife.

Reclaimed wetlands are monitored using the same procedures used to identify wetlands prior to mining disturbances.

3.7.4 Residual Impacts

Replaced wetlands (jurisdictional or functional) may not duplicate the exact function and landscape features of the premining wetland, but all wetland replacement plans would be approved by the COE, which has special required permitting procedures to assure that there will be no net loss of wetlands after reclamation.

3.8 Soils

3.8.1 Affected Environment

Numerous baseline soil surveys associated with surface mining operations and oil field development have been conducted in the eastern PRB. Soil surveys of Campbell County, Wyoming, including the four LBA soils analysis areas, have also recently been conducted by the National Resource Conservation Service (NRCS) (Westerman and Prink 2004). Each of the LBA soils analysis areas includes the BLM study area (the LBA tract as applied for under the Proposed Action and the additional area evaluated under action alternatives), as well as the additional area that would be disturbed in order to recover the coal in the study area (assumed to be a ¼-mile buffer surrounding the BLM study area outside of existing permit boundaries).

Soils vary depending upon where and how they were formed. Major factors involved in the formation of soils include whether or not the material was transported and how the material was weathered during transportation. Four primary soil formation processes causing different soil types were noted in this area: 1) soils developing predominantly in thin residuum from sandstone or shale on upland ridges, 2) soils developing predominantly in slopewash, colluvium, or alluvial fan deposits from mixed sources on gently sloping uplands, 3) soils developing predominantly in coarse-textured alluvium or sandy eolian deposits on rolling uplands, and 4) drainage soils developing in mixed stream laid alluvium on terraces and channels, and in fine-textured playa deposits in depressions and closed basins.

The soil depths and types on the four LBA tracts soils general analysis areas are similar to soils currently being salvaged and utilized for reclamation at the adjacent Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines and other mines in the eastern PRB. Additional detailed information about the soil types on the Belle Ayr North, West Coal Creek, Caballo West and Maysdorf II LBA tracts is included in the supplemental information document, which is available on request. The site-specific soil surveys have located hydric soils and/or inclusions of hydric soils, which are one component used in identifying wetlands. Areas with soils that are not suitable to support plant growth include sites with high alkalinity, salinity, or clay content.

3.8.1.1 Belle Ayr North LBA Tract

The Belle Ayr North LBA tract soils general analysis area (1,947.0 total acres) is the BLM study area for the tract (the LBA tract as applied for and the additional area evaluated under Alternative 2), as well as the additional area that would be disturbed in order to recover the coal in the study area (assumed to be a ¼-mile buffer surrounding the BLM study area outside of existing permit boundaries). Soil surveys were completed in 2007 by James Nyenhuis to an Order 1-2 resolution. The inventories included field sampling and observations at the requisite number of individual sites, and laboratory analysis of representative collected samples. Soils within the Belle Ayr North soils general analysis area were identified by series, which consist of soils that have similar horizons in their profile.

3.8.1.2 West Coal Creek LBA Tract

The West Coal Creek LBA tract soils general analysis area (2,210.1 total acres) is the BLM study area for the tract (the LBA tract as applied for and the additional area evaluated under Alternative 2), as well as the additional area that would be disturbed in order to recover the coal in the study area (assumed to be a ¼-mile buffer surrounding the BLM study area outside of existing permit boundaries). Soil surveys were completed in 2007 by BKS Environmental to an Order 1-2 resolution. The inventories included field sampling and observations at the requisite number of individual sites, and laboratory analysis of representative collected samples. Soils within the soils general analysis area were identified by series, which consist of soils that have similar horizons in their profile.

3.8.1.3 Caballo West LBA Tract

The Caballo West LBA tract soils general analysis area (1,390.4 total acres) is the BLM study area for the tract (the LBA tract as applied for and the additional area evaluated under Alternative 2), as well as the additional area that would be disturbed in order to recover the coal in the study area (assumed to be a ¼-mile buffer surrounding the BLM study area outside of existing permit boundaries). Soil surveys were completed in 2007 by BKS Environmental to an Order 1-2 resolution. The inventories included field sampling and observations at the requisite number of individual sites, and laboratory analysis of representative collected samples. Soils within the soils general analysis area were identified by series, which consist of soils that have similar horizons in their profile.

3.8.1.4 Maysdorf II LBA Tract

The Maysdorf II LBA tract soils general analysis area (6,917 total acres) is the BLM study area for the tract (the LBA tract as applied for and the additional area evaluated under Alternatives 2 and 3), as well as the additional area that would be disturbed in order to recover the coal in the study area (assumed to be a ¼-mile

buffer surrounding the BLM study area outside of existing permit boundaries). Soil surveys were completed in 2007 by James Nyenhuis to an Order 1-2 resolution. The inventories included field sampling and observations at the requisite number of individual sites, and laboratory analysis of representative collected samples. Soils within the soils general analysis area were identified by series, which consist of soils that have similar horizons in their profile.

3.8.2 Environmental Consequences

3.8.2.1 Proposed Action and Alternatives 2 and 3

Removal and replacement of soils during mining and reclamation would cause changes in the soil resources. In reclaimed areas, soil chemistry and soil nutrient distribution would generally be more uniform and average topsoil quality would be improved because soil material that is not suitable to support plant growth would not be salvaged for use in reclamation. This would result in more uniform vegetative productivity on the reclaimed land.

The baseline soils analyses for the LBA tracts indicate that the amount of suitable topsoil that would be available for redistribution on all disturbed acres within the soils general analysis areas during reclamation would vary from an average depth of 1.9 ft to an average depth of 3.1 ft. The replaced topsoil would support a stable and productive vegetation community adequate in quality and quantity to support the planned postmining land uses (wildlife habitat and rangeland).

There would be an increase in the near-surface bulk density of the soil resources on the LBA tract after reclamation. As a result, the average soil infiltration rates would generally decrease, which would increase the potential for runoff and soil erosion. Topographic moderation following reclamation would potentially decrease runoff, which would tend to offset the effects of decreased soil infiltration capacity. The change in soil infiltration rates would not be permanent because revegetation and natural weathering action would form a new soil structure in the reclaimed soils, and infiltration rates would gradually return to premining levels. The reclaimed landscape would contain stable landforms and drainage systems that would support the postmining land uses. Reconstructed stream channels and floodplains would be designed and established to be erosionally stable.

Direct biological impacts to soil resources on each LBA tract would include short-term to long-term reduction in soil organic matter, microbial populations, seeds, bulbs, rhizomes, and live plant parts for soil resources that are stockpiled before placement. The following discussion is a description of potential impacts to soil resources on each LBA tract following reclamation under the Proposed Action or Alternatives 2 or 3.

3.8.2.1.1 Belle Ayr North LBA Tract

Potential impacts to soil resources on the Belle Ayr North LBA tract after final reclamation under the Proposed Action or Alternative 2, BLM's preferred alternative, are quantified as follows. Under the currently approved mining and reclamation plan, approximately 11,621 acres of soil resources will be disturbed in order to mine the coal in the existing leases at the Belle Ayr Mine (table 3-1). The Belle Ayr North LBA tract soil general analysis area is disturbance related to removing coal from the LBA tract under the Proposed Action would directly affect approximately 1,937 additional acres of soil resources not already permitted for disturbance, or approximately 1,947 acres under Alternative 2, BLM's preferred alternative (table 3-1). Average topsoil thickness would be about 26.8 inches across the entire reclaimed surface. The types of soils and the quantities of the soil resource included in the Belle Ayr North LBA tract under the action alternatives considered in this EIS are similar to the soils on the existing leases at the Belle Ayr Mine.

3.8.2.1.2 West Coal Creek LBA Tract

Potential impacts to soil resources on the West Coal Creek LBA tract after final reclamation under the Proposed Action or Alternative 2, BLM's preferred alternative, are quantified as follows. Under the currently approved mining and reclamation plan, approximately 8,355 acres of soil resources will be disturbed in order to mine the coal in the existing leases at the Coal Creek Mine (table 3-2). Preliminary estimates indicate that if the West Coal Creek LBA tract is leased, disturbance related to removing coal from the LBA tract under the Proposed Action would directly affect approximately 1,925 additional acres of soil resources not already permitted for disturbance, or approximately 2,210 acres under Alternative 2, BLM's preferred alternative (table 3-2). Average topsoil thickness would be about 23 inches across the entire reclaimed surface. The types of soils and the quantities of the soil resource included in the West Coal Creek LBA tract under the action alternatives considered in this EIS are similar to the soils on the existing leases at the Coal Creek Mine.

3.8.2.1.3 Caballo West LBA Tract

Potential impacts to soil resources on the Caballo West LBA tract after final reclamation under the Proposed Action or Alternative 2, BLM's preferred alternative, are quantified as follows. Under the currently approved mining and reclamation plan, approximately 16,898 acres of soil resources will be disturbed in order to mine the coal in the existing leases at the Caballo Mine (table 3-3). Preliminary estimates indicate that if the Caballo West LBA tract is leased, disturbance related to removing coal from the LBA tract under the Proposed Action would directly affect approximately 1,350 additional acres of soil resources not already permitted for disturbance, or approximately 1,390 additional acres under Alternative 2, BLM's preferred alternative (table 3-3). Average topsoil

thickness would be about 23 inches across the entire reclaimed surface. The types of soils and the quantities of the soil resource included in the Caballo West LBA tract under the action alternatives considered in this EIS are similar to the soils on the existing leases at the Caballo Mine.

3.8.2.1.4 Maysdorf II LBA Tract

Potential impacts to soil resources on the Maysdorf II LBA tract after final reclamation under the Proposed Action or Alternative 3, BLM's preferred alternative, are quantified as follows. Under the currently approved mining and reclamation plan, approximately 14,694 acres of soil resources will be disturbed in order to mine the coal in the existing leases at the Cordero Rojo Mine (table 3-4). Preliminary estimates indicate that if the Maysdorf II LBA tract is leased, disturbance related to removing coal from the LBA tract under the Proposed Action would directly affect approximately 6,675 additional acres of soil resources, or approximately 6,917 additional acres under Alternative 3, BLM's preferred alternative (table 3-4). Average topsoil thickness would be about 23 inches across the entire reclaimed surface. The types of soils and the quantities of the soil resource included in the Maysdorf II LBA tract under the action alternatives considered in this EIS are similar to the soils on the existing leases at the Cordero Rojo Mine.

3.8.2.2 No Action Alternative

Under the No Action alternatives, the coal lease applications would be rejected and coal removal and the associated disturbance and impacts to soils would not occur on the additional acres included in the four LBA tracts. The additional acres disturbed in the Proposed Action or other action alternatives for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts are listed in tables 2-1 through 2-4, respectively. Coal removal and the associated soil removal and replacement would occur on the existing mine leases as currently permitted (as summarized in tables 3-1 through 3-4). Impacts to soils related to mining operations at the existing mines would not be extended onto portions of the LBA tracts that will not be affected under the current mining and reclamation plan.

As discussed in section 2.2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.8.3 Regulatory Compliance, Mitigation and Monitoring

Soils suitable to support plant growth would be salvaged for use in reclamation. Soil stockpiles would be protected from disturbance and erosional influences. Soil material that is not suitable to support plant growth would not be salvaged. Soil or overburden materials containing potentially harmful chemical constituents (such as selenium) would be specially handled.

Unsuitable materials would be buried under adequate fill (at least 4 feet of suitable overburden) prior to soil redistribution to meet guidelines for vegetation root zones. After topsoil is redistributed on reclaimed surfaces, revegetation would reduce wind erosion. Sediment control structures would be constructed as needed to detain sediments.

Regraded overburden would be sampled to verify suitability as subsoil for compliance with root zone criteria. Redistributed soil would be sampled to document redistribution depths. Vegetation growth would be monitored on reclaimed areas to confirm vegetation establishment and acceptability for bond release. Appropriate normal husbandry practices may be implemented to achieve specific reclamation goals.

These measures are required by regulation and are therefore considered to be part of the Proposed Action and other action alternatives for the Belle Ayr South, West Coal Creek, Caballo West and Maysdorf II LBA tracts.

3.8.4 Residual Impacts

Existing soils would be mixed and redistributed, and soil-forming processes would be disturbed by mining. This would result in long-term alteration of soil characteristics.

3.9 Vegetation

3.9.1 Affected Environment

The vegetation general analysis area for each tract includes the BLM study area (the LBA tract as applied for under the Proposed Action and the additional area evaluated under the other action alternatives plus an additional area (assumed to be a ¼-mile buffer that would be disturbed in order to recover the coal in the BLM study area outside of existing permit boundaries). Each of the SGAC LBA tracts' vegetation general analysis area contains portions that are partially located within and adjacent to current mine permit boundaries. Consequently, portions of the vegetation general analysis areas were previously mapped and sampled in accordance with the current WDEQ/LQD mine permitting requirements. The balance of the vegetation assessments were completed for the Belle Ayr North and for the Maysdorf II LBA tracts by ESCO Associates, Inc. of Boulder, Colorado in 2006and 2007 and for the West Coal Creek and Caballo West LBA tracts by BKS Environmental Associates, Inc. of Gillette, Wyoming in 2007. The vegetation communities in theses areas were appraised and mapped to provide a preliminary assessment.

The vegetation within the analysis areas consists of species common to eastern Wyoming and consistent with vegetation that occurs within the adjacent mine permit areas. Water and disturbed areas were also mapped. The following

vegetation types were identified in the combined LBA vegetation general analysis areas:

- Crested Wheatgrass Pasture
- Cropland
- Hayland
- Grainland
- Sagebrush/Grassland
- Big Sagebrush
- Silver Sagebrush
- Saline Grassland
- Sandy Grassland
- Loamy Grassland
- Playa Grassland
- Upland Grassland
- Mixed Grass Prairie
- Rough Breaks
- Rock Outcrop/Blowout
- Streamside Bottomlands
- Meadow
- Lowland Grassland
- Draw Bottomland
- Water
- Topsoil Stockpiles
- Reclaimed Area
- Disturbed Area
- Pre-Mining Disturbance
- Developed

Table 3-12 presents the acreage and percent of the combined general analysis areas encompassed by each vegetation type. Additional more-detailed information about the vegetation types within the LBA tract is included in the supplemental information document, which is available on request.

In terms of total acres of occurrence in the combined vegetation general analysis areas, the predominant vegetation types are the Sagebrush/Grassland (38.07percent) and Sandy Grassland (18.41 percent). Common plant species on these types include crested wheatgrass, smooth brome, needle and thread, threadleaf sedge, western wheatgrass, blue grama, and cheatgrass brome. Dominant shrubs/subshrubs in the Sagebrush/Grassland and Sandy Grassland vegetation communities include Wyoming big sagebrush and fringed sage. Lichens and manyspine plains pricklypear cactus are frequently large components of the vegetation cover.

The predominant vegetation type on approximately 10 percent of the vegetation general analysis area is the crested wheatgrass pasture. This type consists of

Table 3-12. Vegetation Types Identified and Mapped Within the Combined LBA Vegetation General Analysis Areas.

Vegetation Type	Acres	Percent of Area
Sagebrush Grassland	4,744.73	38.07%
Sandy Grassland	2,294.52	18.41%
Crested Wheatgrass Pasture	1,238.36	9.93%
Mixed Grass Prairie	740.57	5.94%
Disturbed Area	693.24	5.56%
Saline Grassland	314.64	2.52%
Big Sagebrush	302.65	2.43%
Cropland	296.80	2.38%
Silver Sagebrush	276.85	2.22%
Rough Breaks	228.01	1.83%
Streamside Bottomlands	209.94	1.68%
Playa Grassland	208.35	1.67%
Pre-Mining Disturbance	177.26	1.42%
Loamy Grassland	171.77	1.38%
Hayland	98.55	0.79%
Topsoil Stockpiles	90.00	0.72%
Grainland	83.90	0.67%
Upland Grassland	83.90	0.67%
Reclaimed Area	73.41	0.59%
Draw Bottomland	55.16	0.44%
Pastureland	28.00	0.22%
Lowland Grassland	21.60	0.17%
Burn	13.22	0.11%
Rock Outcrop/Blowout	5.50	0.04%
Meadow	5.40	0.04%
Developed	4.60	0.04%
Water	3.80	0.03%
Total	12,464.73	100.00%

Source: BKS 2007a and 2007b, ESCO 2007a and 2007b

areas that have been converted (at least originally and intentionally) from native vegetation of one of the above-described types to a monoculture of crested wheatgrass. Through time, those areas that have not been actively managed are likely to experience invasion by native plant species from adjacent areas. Blue grama, purple threeawn, Junegrass, and needle and thread are among the more commonly invading grasses.

The various categories of disturbance (topsoil stockpiles, reclaimed area, disturbed area, pre-mining disturbance, and developed areas) account for approximately 8 percent of the vegetation general analysis area. Areas mapped as disturbed are

mostly associated with advancing excavation associated with the backslopes of mine pits, disturbance associated with CBNG activity (roads to drill pads, wellpads, and pipeline construction), areas recently excavated and contoured as part of construction of a flood control, and rights-of-way for public roads.

There are few occurrences of noxious weeds in the mine area; however, there are native areas adjacent to mine permit areas that are infested with noxious weeds, primarily Canada thistle

3.9.2 Environmental Consequences

3.9.2.1 Proposed Action and Alternatives 2 and 3

Under the currently approved mining and reclamation plans, approximately 51,568 acres of vegetation will be disturbed in order to mine the coal in the existing leases at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines. Under Alternative 2 (Alternative 3 for the Maysdorf II LBA tract), BLM's preferred alternatives, mining of the four LBA tracts would progressively remove the native vegetation on approximately 12,465 additional acres on and near the LBA tracts. Vegetation removal on the LBA tracts under the Proposed Action and other action alternatives is presented as the additional mine disturbance area in tables 3-1 through 3-4.

Short-term impacts associated with the removal of vegetation from the LBA tracts would include increased soil erosion and habitat loss for wildlife and livestock. Potential long-term impacts include loss of habitat or loss of habitat carrying capacity for some wildlife species as a result of reduced plant species diversity or reduced plant density for some species, particularly big sagebrush, on reclaimed lands. However, grassland-dependent wildlife species and livestock would benefit from the increased grass cover and production.

Reclamation, including revegetation of these lands, would occur contemporaneously with mining on adjacent lands, i.e., reclamation would begin once an area is mined. Estimates of the time elapsed from soil stripping through reseeding of any given area range from 2 to 4 years. This would be longer for areas occupied by stockpiles, haulroads, sediment-control structures, and other mine facilities. Some roads and facilities would not be reclaimed until the end of mining. No new life-of-mine facilities would be located on the LBA tracts under the Proposed Action or Alternatives 2 or 3 because the LBA tracts would be mined as an extension of an existing mine using existing facilities.

Grazing restrictions prior to mining and during reclamation would remove up to 100 percent of the LBA areas from livestock grazing. This reduction in vegetative production would not seriously affect livestock production in the region, and long-term productivity on the reclaimed land would return to premining levels within several years following seeding with the approved final seed mixture. There would

not be a substantial restriction of wildlife use of the area throughout the operations.

In an effort to approximate premining conditions, the applicants would plan to reestablish vegetation types that are similar to the premine types during the reclamation operation. Reestablished vegetation would be dominated by species mandated in the reclamation seed mixtures (to be approved by WDEQ). The majority of the approved species are native to the LBA tracts. Initially, the reclaimed lands would be primarily a mixture of prairie grasslands with graminoid/forb-dominated areas. An overall reduction in species diversity, especially for the shrub component, would occur. At least 20 percent of the native vegetation area would be reclaimed to native shrubs at a density of one per square meter as required by current regulations. Estimates for the time it would take to restore shrubs, including sagebrush, to premining density levels range from 20 to 100 years. As indicated previously, sagebrush is a component of the Sagebrush/Grassland vegetation community, which occupies about 39 percent of the vegetation general analysis areas. Following completion of reclamation (seeding with the final seed mixture) and before release of the reclamation bond (a minimum of 10 years), a diverse, productive, and permanent vegetative cover would be established on the LBA tracts. The decrease in plant diversity would not seriously affect the potential productivity of the reclaimed areas, regardless of the alternative selected. The proposed postmining land use (wildlife habitat and rangeland) should be achieved even with the changes in vegetation composition and diversity. Native vegetation from surrounding areas would gradually invade and become established on the reclaimed land. Following reclamation bond release, management of the privately owned surface areas would revert back to the private surface owners, who would have the right to manipulate the reclaimed vegetation.

A reduction in sagebrush would result in a long term reduction of habitat for some species and may delay use of the reclaimed area by shrub-dependent species, such as the sage-grouse (*Centrocercus urophasianus*). An indirect impact of this vegetative change could be decreased big game habitat carrying capacity.

On average, roughly 1,600 to 2,000 acres of surface would be disturbed per year of mining if all four proposed lease areas are mined concurrently, regardless of which alternatives are selected. By the time mining ceases, over 75 percent of these disturbed lands would have been reseeded. The remaining 25 percent would be reseeded during the following 2 to 3 years as the life-of-mine facilities area is reclaimed.

The reclamation plans for the existing mines include steps to control invasion by weedy (invasive nonnative) plant species because WDEQ/LQD rules and regulations require surface coal mine operators to control and minimize the introduction of noxious weeds until bond release, in accordance with federal and state regulatory requirements. Section 3.9.4 includes a discussion of the steps

the mines use to control noxious weeds. As a result, there are few occurrences of noxious weeds in the mine areas. The reclamation plan for each LBA tract would also include steps to control invasion from such species.

Wyoming, including the PRB, has experienced drought conditions since around 2000. The climatic record of the western U.S. suggests that droughts could occur periodically during the life of the applicant mines. Such droughts would severely hamper revegetation efforts, since lack of sufficient moisture would reduce germination and could damage newly established plants. In such instances, reseeding may be necessary. Same-aged vegetation would be more susceptible to disease than would plants of various ages. Droughts could also result in stands of vegetation in which less gregarious plants like warm season grasses are better established. Severe thunderstorms could also adversely affect newly seeded areas. However, these events would have similar impacts as would occur on native vegetation once a stable vegetative cover is established.

Changes expected in the surface water network on each LBA tract as a result of mining and reclamation would affect the reestablishment of vegetation patterns on the reclaimed areas to some extent. The postmining maximum overland slope would be 20 percent, in accordance with WDEQ policy. The average reclaimed overland slope on each LBA tract would not be known until WDEQ's technical review of each permit revision application is complete. No major changes in the average overland slope are predicted.

There would be no net loss of jurisdictional wetlands. They would be restored under the jurisdiction of the COE (section 3.7). Non-jurisdictional and functional wetlands would be restored in accordance with the requirements of the surface landowner or as required by WDEQ/LQD.

3.9.2.2 No Action Alternative

Under the No Action alternative, the coal lease applications would be rejected and coal removal and the associated disturbance and impacts to vegetation would not occur on the additional acres included in the four LBA tracts. The additional acres disturbed in the Proposed Action or other action alternatives for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts are listed in tables 2-1 through 2-4, respectively. Coal removal and the associated removal and replacement of vegetation would occur on the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines leases as currently permitted (as summarized in tables 3-1 through 3-4, respectively). Impacts to vegetation related to mining operations at the existing mines would not be extended onto portions of the LBA tracts that will not be affected under the current mining and reclamation plans.

As discussed in section 2.2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.9.3 Threatened, Endangered, Proposed, and Candidate Plant Species, and BLM Sensitive Species

Refer to appendix E the each of the four SGAC Biological Assessments and to appendix F for the SGAC Sensitive Species Evaluation.

3.9.4 Regulatory Compliance, Mitigation and Monitoring

Reclaimed areas would be revegetated as specified in the approved mine plan using reclamation seed mixtures that would be approved by WDEQ. The majority of the species would be native to the LBA tract. At least 20 percent of the native vegetation area would be reclaimed to native shrubs at a density of one per square meter as required by current regulations. Shrubs would be selectively planted in riparian areas.

WDEQ/LQD Rules and Regulations require that:

- Permit applications for surface coal mines include a description of any weeds or other plants listed by the local Weed and Pest Control District as harmful (Chapter 2, Section 2(a)(vi)(C)(2)); and
- Surface coal mine operators control and minimize the introduction of noxious weeds in accordance with federal or state requirements (Chapter 4, Section 2(d)(xiv)).

In accordance with these requirements, the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines work with the Campbell County Weed and Pest Department and conducts an active noxious weed control program on their existing coal leases and would be required to continue those practices if the mines acquire leases for the applied for LBA tracts.

Detailed wetland mitigation plans would be developed and approved by COE during the permitting stage to ensure no net loss of jurisdictional wetlands occurs within the total disturbance areas (section 3.7). Non-jurisdictional and functional wetlands would be restored in accordance with the requirements of the surface landowner or as required by WDEQ/LQD, as discussed in section 3.7.

Revegetation growth and diversity would be monitored until the final reclamation bond is released (a minimum of 10 years following seeding with the final seed mixture). Erosion would be monitored to determine if there is a need for corrective action during establishment of vegetation. Controlled grazing would be used during revegetation to determine the suitability of the reclaimed land for post-mining land uses.

3.9.5 Residual Impacts

Reclaimed vegetative communities may never completely match the surrounding native plant community.

3.10 Wildlife

3.10.1 General Setting

This section discusses the affected environment and potential environmental consequences to wildlife in general. The subsequent sections address the potential impacts to specific groups of wildlife species.

3.10.1.1 Affected Environment

Background information on wildlife in the general South Gillette analysis area was drawn from several sources, including the Maysdorf Coal Lease Application FEIS (BLM 2007b), Wyoming Game and Fish Department (WGFD) and U.S. Fish and Wildlife Service (USFWS) records, and personal contacts with WGFD and USFWS biologists. Site-specific data for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts were obtained from several sources, including WDEQ/LQD mine permit applications and annual wildlife monitoring reports for the applicant mines. In addition, FCW conducted baseline investigations during 2006 and early 2007 specifically for the Belle Ayr North LBA tract; TBCC conducted baseline investigations during 2006 and early 2007 expressly for the West Coal Creek LBA tract; CCC conducted baseline investigations during 2006 and early 2007 expressly for the Caballo West LBA tract; and CMC conducted baseline investigations during 2006 specifically for the Maysdorf II LBA tract. Baseline and annual wildlife surveys cover a large perimeter around the mine permit areas; consequently, a majority of the proposed lease areas have been surveyed as part of the required monitoring surveys for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines. Site-specific surveys for each lease area and appropriate perimeter would be part of the mine permitting process if the tracts are leased.

The topography within the general South Gillette analysis area is mainly gently rolling and of moderate relief, influenced by the Belle Fourche River and it's tributaries. Elevation ranges from approximately 4,515 to 4,885 ft above sea level. Rough breaks and streamside bottomland areas occur near the Belle Fourche River and Tisdale, Caballo, and Coal Creeks, which flow through the general South Gillette analysis area (figure 3-24).

In an undisturbed condition, the major vegetation types in the vegetation general analysis areas (discussed in section 3.9) provide high quality habitats for many species. Vegetation types tend to occur in a mosaic across the landscape; therefore, many wildlife species can be expected to utilize more than one habitat

type. Wildlife habitat types for the LBA tracts generally coordinated with the mapped vegetation communities but the general habitat types for the general South Gillette analysis area include shrubland, native grasslands, seeded grassland, streamside bottomland, and rough breaks. Various parcels of cultivated land also occur throughout the area. As a result of oil and gas development, there are networks of road and well-pad disturbance areas overlaying much of the areas, as well as tank batteries and miles of pipeline disturbance with varying degrees of recovering vegetative cover. No designated critical, crucial, or unique habitats are present.

The predominant habitat is Sagebrush/Grassland and Sandy Grassland is the next largest habitat type (table 3-12). Seeded grassland is dominated by crested wheatgrass, but older seedings have a mixture of less dominant native plant species and, with the passage of time, these seedings begin to resemble Sagebrush/Grassland again. Bottomland grassland or streamside bottomland habitat is limited to a narrow band along the edges of the Belle Fourche River in the southern portion of the general South Gillette analysis area. Trees are limited along the river and its tributaries within the general South Gillette analysis area. Rough breaks habitat is distinguished by the irregularity of vegetation, slopes, and soils. Vegetation on the rough breaks is typically sparse, although the diversity of vascular plant species is greater than in the Sagebrush/Grassland and sandy grassland communities.

Under natural conditions portions of Caballo Creek and the Belle Fourche River demonstrate characteristics of both an intermittent and ephemeral stream. All other streams within and adjacent to the LBA tracts are ephemeral. In response to surface discharge of groundwater associated with CBNG production upstream of the LBA tracts, which is a relatively recent phenomenon, streamflow occurrence is now more persistent. The Belle Fourche River and the distinctive shallow pools that are present along its natural course in the general South Gillette analysis area are now seldom completely dry, resulting in an increase in habitat for waterfowl, shorebirds, and aquatic species. Twenty-five small stock reservoirs and three playa areas exist within the four LBA tract study boundaries. One of the playas has been turned into a temporary shallow pond as the result of a CBNG well discharging within its drainage area.

Cordero Rojo Mine's approved WDEQ/LQD mine permit allows disturbance of the Belle Fourche River channel. Approximately 6 miles of the natural channel have been diverted to date within the Cordero Rojo Mine's current permit area. CMC would propose another diversion of the Belle Fourche River if they acquire a lease for the Maysdorf II LBA tract.

3.10.1.2 Environmental Consequences

3.10.1.2.1 Proposed Action and Alternatives 2 and 3

If the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts were leased under the Proposed Action or Alternative 2, BLM's preferred alternative, (Alternative 3 for the Maysdorf II LBA tract), coal removal and associated mining disturbance would extend onto the LBA tracts. Mining would be extended by 5.0 years at the Belle Ayr Mine, 4.3 years at the Coal Creek Mine and 2.4 years at the Caballo Mine under Alternative 2, BLM's preferred alternative, and approximately 10.0 years at the Cordero Rojo Mine under Alternative 3, BLM's preferred alternative. Impacts to wildlife that would be caused by mining the LBA tracts would be addressed by the WGFD and the WDEQ/LQD when the mining and reclamation permits are amended to include the LBA tracts.

Mining directly and indirectly impacts local wildlife populations. These impacts are both short-term (until successful reclamation is achieved) and long-term (persisting beyond successful completion of reclamation). The direct impacts of surface coal mining on wildlife occur during mining and are therefore short-term. They include road kills by mine-related traffic, restrictions on wildlife movement created by fences, spoil piles, and pits, and displacement of wildlife from active mining areas. Displaced animals may find equally suitable habitat that is not occupied by other animals, occupy suitable habitat that is already being used by other individuals, or occupy poorer quality habitat than that from which they were displaced. In the second and third situations, the animals may suffer from increased competition with other animals and are less likely to survive and reproduce. If the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts were leased and mined, the direct impacts related to mine traffic and mine operations would be extended within the general South Gillette analysis area by nearly 10 years.

The indirect impacts are longer term. After the LBA tracts are leased, mined, and reclaimed, alterations in the topography and vegetative cover, particularly the reduction in sagebrush density, would cause a decrease in carrying capacity for some species and a decrease in vegetative diversity. Sagebrush would gradually become reestablished on the reclaimed land, but the topographic changes would be permanent. Microhabitats may be reduced on reclaimed land due to flatter topography, less diverse vegetative cover, and reduction in sagebrush density.

3.10.1.2.2 No Action Alternative

Under the No Action alternatives, the coal lease applications would be rejected and coal removal and the associated disturbance and impacts to wildlife would not occur on the additional acres included in the four LBA tracts. The additional acres disturbed in the Proposed Action or other action alternatives for the Belle Ayr

North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts are listed in tables 2-1 through 2-4, respectively. Coal removal and the associated impacts to wildlife would occur on the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines leases as currently permitted to recover the coal in the existing leases.

As discussed in section 2.2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.10.2 Big Game

3.10.2.1 Affected Environment

The two big game species that are common in suitable habitat throughout the general South Gillette analysis area are pronghorn (*Antilocapra americana*) and mule deer (*Odocoileus hemionus*). White-tailed deer (*Odocoileus virginianus*) and elk (*Cervus elaphus*) are transients east of the general South Gillette analysis area. No crucial big game habitat or migration corridors are recognized by the WGFD in this area.

Pronghorn are by far the most common big game species in this area. This species is most abundant in the sagebrush/grassland or mixed-grass prairie habitats. Reclaimed grassland constitutes only a small portion of the available habitat around the PRB mines, although pronghorn are observed during all seasonal surveys in these areas. Home range for pronghorn can vary between 400 acres to 5,600 acres, according to several factors including season, habitat quality, population characteristics, and local livestock occurrence. Typically, daily movement does not exceed 6 miles. Pronghorn may make seasonal migrations between summer and winter habitats, but migrations are often triggered by availability of succulent plants and not local weather conditions (Fitzgerald et al. 1994). The WGFD has classified the general South Gillette analysis area as primarily winter/yearlong pronghorn range (a population or a portion of a population of animals makes general use of this habitat on a year-round basis, with a significant influx of additional animals onto this habitat from other seasonal ranges in the winter) and yearlong pronghorn range (a population or substantial portion of a population of animals makes general use of this habitat on a year-round basis, but may leave the area under severe conditions on occasion). The entire general South Gillette analysis area is within the WGFD Highlight Herd Unit. In post-season 2007, the WGFD estimated the Hilight Herd Unit to be 12,397 animals, with an objective of 11,000 (WGFD 2008).

Mule deer use nearly all habitats, but prefer sagebrush/grassland, rough breaks, and riparian bottomland. Browse is an important component of the mule deer's diet throughout the year, comprising as much as 60 percent of total intake during autumn, while forbs and grasses typically make up the rest of their diet (Fitzgerald et al. 1994). Mule deer are frequently observed on mine reclaimed lands. In

certain areas of the state this species tends to be more migratory than white-tailed deer, traveling from higher elevations in the summer to winter ranges that provide more food and cover. However, monitoring has indicated that mule deer are not very migratory in the vicinity of the general South Gillette analysis area. The WGFD has classified a majority of the general South Gillette analysis area as being out of normal mule deer use range and a small portion as being yearlong mule deer use range, which means that a population or substantial portion of a population of animals makes general use of this habitat on a year-round basis, but may leave the area under severe conditions on occasion. The entire area is located within the WGFD Thunder Basin Mule Deer Herd Unit. No crucial or critical mule deer ranges or migration corridors occur on or within several miles of the general South Gillette analysis area. Crucial range is defined as any particular seasonal range or habitat component that has been documented as the determining factor in a population's ability to maintain and reproduce itself at a certain level. The WGFD estimated the 2007 post-season mule deer population for the herd unit at 20,980, which is slightly above the current objective of 20,000 (WGFD 2008).

White-tailed deer are generally managed separately by the WGFD in the Central Herd Unit. White-tailed deer prefer riparian habitats and are therefore seldom observed in the general South Gillette analysis area due to the lack of that particular habitat. The WGFD classifies the entire general South Gillette analysis area as out of the normal white-tailed deer use range. A narrow corridor along the Belle Fourche River east of the Belle Ayr North LBA tract wildlife general analysis area is classified as yearlong range. White-tailed deer are occasionally recorded along the Belle Fourche River and Pine Hills to the east but have rarely been recorded in the general South Gillette analysis area.

A resident elk herd resides in the Rochelle Hills south of the general South Gillette analysis area. Elk do wander from the protection of the Rochelle Hills to forage in native and reclaimed grasslands in the vicinity of the general South Gillette analysis area. None of the general South Gillette analysis area is classified by the WGFD as within normal elk use range. As more lands are reclaimed from mining, elk are shifting their winter use to these areas. The WGFD has designated an approximately 5 square mile area on reclaimed lands within the Jacobs Ranch Mine permit area as crucial winter habitat for the Rochelle Hills elk herd (Oedekoven 1994). Rio Tinto Energy America (RTEA), owner of the Jacobs Ranch Mine, and the RMEF finalized a formal agreement that created the Rochelle Hills Conservation Easement. The easement contains nearly 1,000 acres, with 75 percent of that total comprised of reclaimed mining lands on RTEA's Jacobs Ranch Mine. The easement acreage was donated to RMEF by RTEA to ensure that the reclaimed land continues to be used as grazing land and wildlife habitat for the extended future (RMEF 2007). The Jacobs Ranch Mine is located about 9 miles south of the general South Gillette analysis area (figure 1-1). Elk have been observed within the general South Gillette analysis area in recent years, but they are typically restricted to the pine breaks east of the Cordero Rojo and Coal Creek

mines. Limited observations have also been documented in and near the Belle Ayr Mine permit area in the last few years.

3.10.2.2 Environmental Consequences

3.10.2.2.1 Proposed Action and Alternatives 2 and 3

Under the Proposed Action and Alternative 2 (Alternative 3 for the Maysdorf II LBA tract), BLM's preferred alternatives, big game would be displaced from portions of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts to adjacent ranges during mining. Pronghorn would be most affected; however, no areas classified as crucial pronghorn habitat occur on or within 2 miles of the LBA tracts. Mule deer would not be substantially impacted, given their infrequent use of these lands and the availability of suitable habitat in adjacent areas. White-tailed deer are not usually found in the area but are occasionally observed to the east. None of the land within the general South Gillette analysis area is considered by WGFD to be an elk use area and few elk have been observed within the vicinity of the general South Gillette analysis area in recent years. Those elk that were seen in the area were largely restricted to the pine breaks habitats in the eastern-most perimeter. Big game displacement would be incremental, occurring over several years and allowing for gradual changes in distribution patterns. Big game residing in the adjacent areas could be impacted by increased competition with displaced animals. Noise, dust, and associated human presence would cause some localized avoidance of foraging areas adjacent to mining activities. On the existing coal leases, however, big game have continued to occupy areas adjacent to and within active mining operations, suggesting that some animals may become habituated to such disturbances.

Big game animals are highly mobile and can move to undisturbed areas. There would be more restrictions on big game movement on or through the proposed LBA tracts, however, due to the construction of additional fences, spoil piles, and pits related to mining. During winter storms, pronghorn may not be able to negotiate these barriers. WDEQ guidelines require fencing to be designed to permit pronghorn passage to the extent possible.

Following reclamation, topographic moderation and changes in vegetation may result in a long-term reduction in big game carrying capacity, with effects varying by species. Eventual restoration of important shrub habitats would allow for the return of some animals to reclaimed mine lands over time.

3.10.2.2.2 No Action Alternative

The impacts to big game under the No Action alternatives would be similar to the impacts described in section 3.10.1.2.2 and above for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine areas.

3.10.3 Other Mammals

3.10.3.1 Affected Environment

A variety of small and medium-sized mammal species occur in the vicinity of the general South Gillette analysis area, although not all have been observed on the LBA tracts themselves. These include predators and furbearers, such as the coyote (*Canis latrans*), red fox (*Vulpes vulpes*), bobcat (*Lynx rufus*), striped skunk (*Mephitis mephitis*), long-tailed weasel (*Mustela frenata*), badger (*Taxidea taxus*), muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*), and beaver (*Castor canadensis*). Prey species include various rodents (such as mice, rats, voles, gophers, ground squirrels, chipmunks, muskrats, black-tailed prairie dogs [*Cynomys ludovicianus*], and lagomorphs [jackrabbits and cottontails]). These prey species are cyclically common and widespread throughout the region. Porcupines (*Erethizon dorsatum*) and bats (such as hoary [*Lasiurus cinereus*] and big brown [*Eptesicus fuscus*]) also have habitat in the vicinity, primarily east of the Cordero Rojo Mine area. The prey species are important for raptors and other predators.

The black-tailed prairie dog was added to the list of candidates for federal listing as a threatened or endangered species under the Endangered Species Act on February 4, 2000. The USFWS then removed the black-tailed prairie dog from the list of candidate species on August 12, 2004. On December 2, 2008, the USFWS announced a 90-day finding on a petition seeking federal protection of the black-tailed prairie dog under the ESA. The USFWS subsequently announced that it will conduct a 12-month finding, which will end February 2, 2009, to determine if listing of the species is warranted (USFWS 2009). The USFWS continues to encourage the protection of prairie dog colonies for their value to the prairie ecosystem and the myriad of species that rely on them (USFWS 2004a). The black-tailed prairie dog is a BLM Sensitive Species.

The black-tailed prairie dog is a highly social, diurnally active, burrowing mammal. Aggregations of individual burrows, known as colonies, form the basic unit of prairie dog populations. Found throughout the Great Plains in short-grass and mixed-grass prairie areas (Fitzgerald et al. 1994), the black-tailed prairie dog has declined in population numbers and extent of colonies in recent years. The three major impacts that have influenced black-tailed prairie dog populations are the initial conversion of prairie grasslands to cropland in the eastern portion of its range from approximately the 1880s-1920s; large-scale control efforts conducted from approximately 1918 through 1972, when an Executive Order was issued banning the use of compound 1080; and the introduction of sylvatic plague into North American ecosystems in 1908 (USFWS 2000 and 2009).

In Wyoming, this species is primarily currently found in isolated populations in the eastern half of the state (Clark and Stromberg 1987). The species is considered a common resident in eastern Wyoming, utilizing short-grass and mid-grass habitats (Cerovski et al. 2004). USFWS's most recent estimate of occupied

black-tailed prairie dog habitat in Wyoming, which was made in 2004, is approximately 125,000 acres (USFWS 2004b). Many other wildlife species, such as the black-footed ferret (*Mustela nigripes*), swift fox (*Vulpes velox*), mountain plover (*Charadrius montanus*), ferruginous hawk (*Buteo regalis*), and burrowing owl (*Athene cunicularia*) may be dependent on the black-tailed prairie dog for some portion of their life cycle (USFWS 2000 and 2009).

According to U.S. Department of Agriculture - Forest Service (USFS) observations on the Thunder Basin National Grassland, the largest concentrations of prairie dog colonies in the vicinity of the eastern PRB surface coal mines are found east of the coal burnline, which is outside and east of the area of surface coal mining (Tim Byer, personal communication 9/11/2003). The large prairie dog complexes in this area east of the coal burnline have been drastically impacted by outbreaks of plague. The prairie dog colonies west of the burnline, including the areas near the Belle Ayr North, West Coal Creek, Caballo West or Maysdorf II LBA tracts, are generally smaller and less densely concentrated. These colonies have not been affected by plague to the same degree, likely due to their reduced size and density.

Qualified wildlife biologists with Intermountain Resources and Jones & Stokes have mapped the current acreage of prairie dog colonies in the vicinity of the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines by walking the perimeters of colonies and delineating them using hand-held global positioning system receivers and/or by visually mapping them on topographic maps (figures 3-25 through 3-28, respectively). There are overlaps between portions of the four prairie dog survey area boundaries but there is no overlap in the depiction of colonies on these figures or in the tract discussions that follow below. A total of three occupied prairie dog colonies encompassing approximately 130.4 non-contiguous acres were present on and within 2 miles of the general analysis areas for these four LBA tracts in 2007. A portion (13.3 acres) of one prairie dog colony is located within the four combined general analysis areas.

No colonies are currently present on or within 2 miles of the Belle Ayr North or Caballo West LBA tracts under the Proposed Actions or action alternatives. One small colony is present approximately 1.25 miles southeast of the West Coal Creek LBA tract general analysis area (figure 3-26). That colony was poisoned in the past and was only occupied again beginning in 2000. Two other small colonies are located within 2 miles of the Maysdorf II LBA tract general analysis area (figure 3-28). One colony is located east of the CMC mine permit area is not within 2 miles of the Maysdorf II general analysis area. The boundaries shown on figures 3-26 and 3-28 are historical town boundaries and, although black-tailed prairie dogs still exist in the areas, their numbers and distribution may be much smaller than previously recorded.

The black-tailed prairie dog is recognized as a BLM Sensitive Species and is further discussed in the Sensitive Species Evaluation (appendix F) of this EIS.

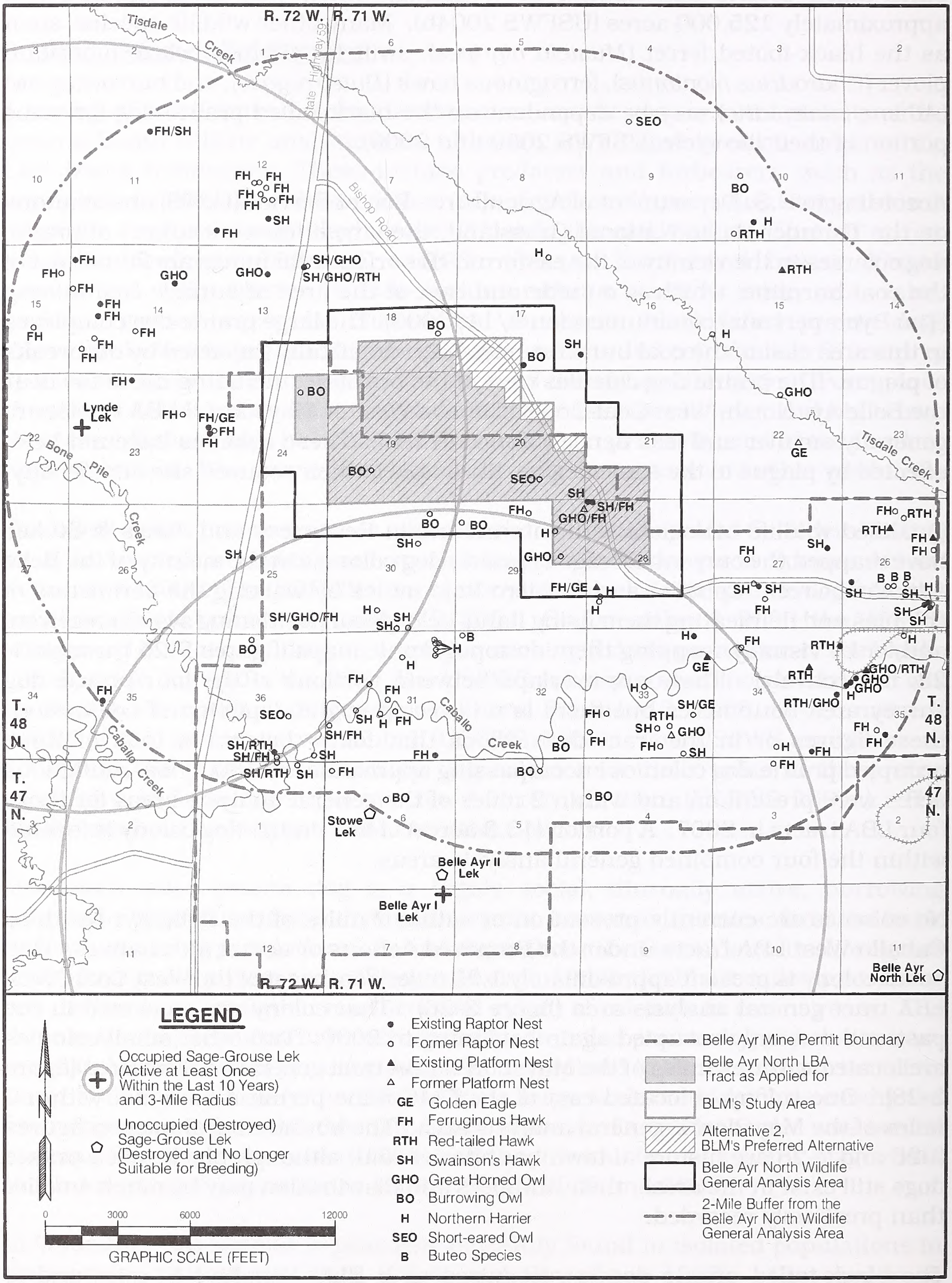


Figure 3-25. Raptor Nest Sites and Sage-Grouse Leks Within and Adjacent to the Belle Ayr North LBA Tract.

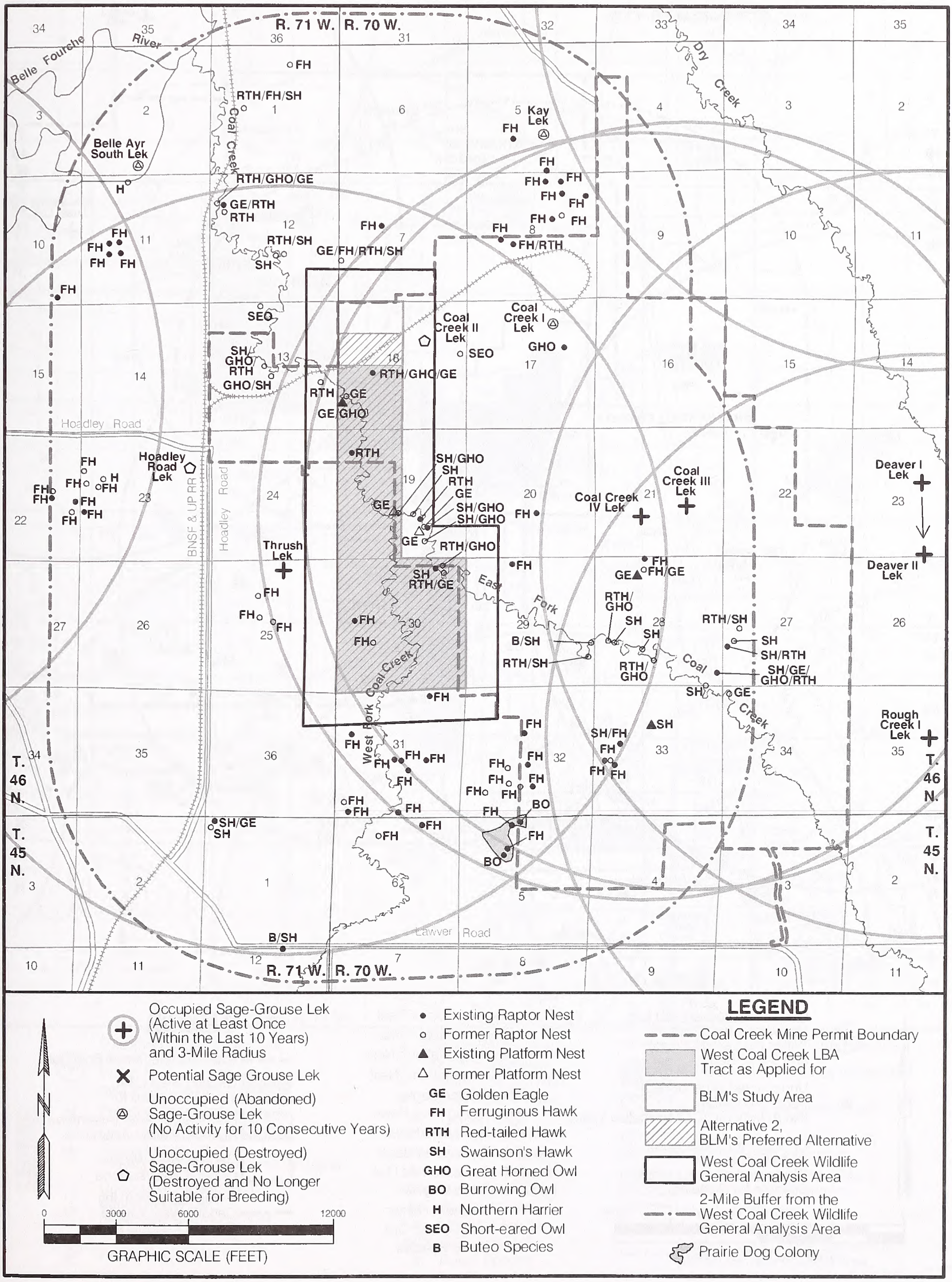


Figure 3-26. Raptor Nest Sites, Sage-Grouse Leks, and Prairie Dog Colonies Within and Adjacent to the West Coal Creek LBA Tract.

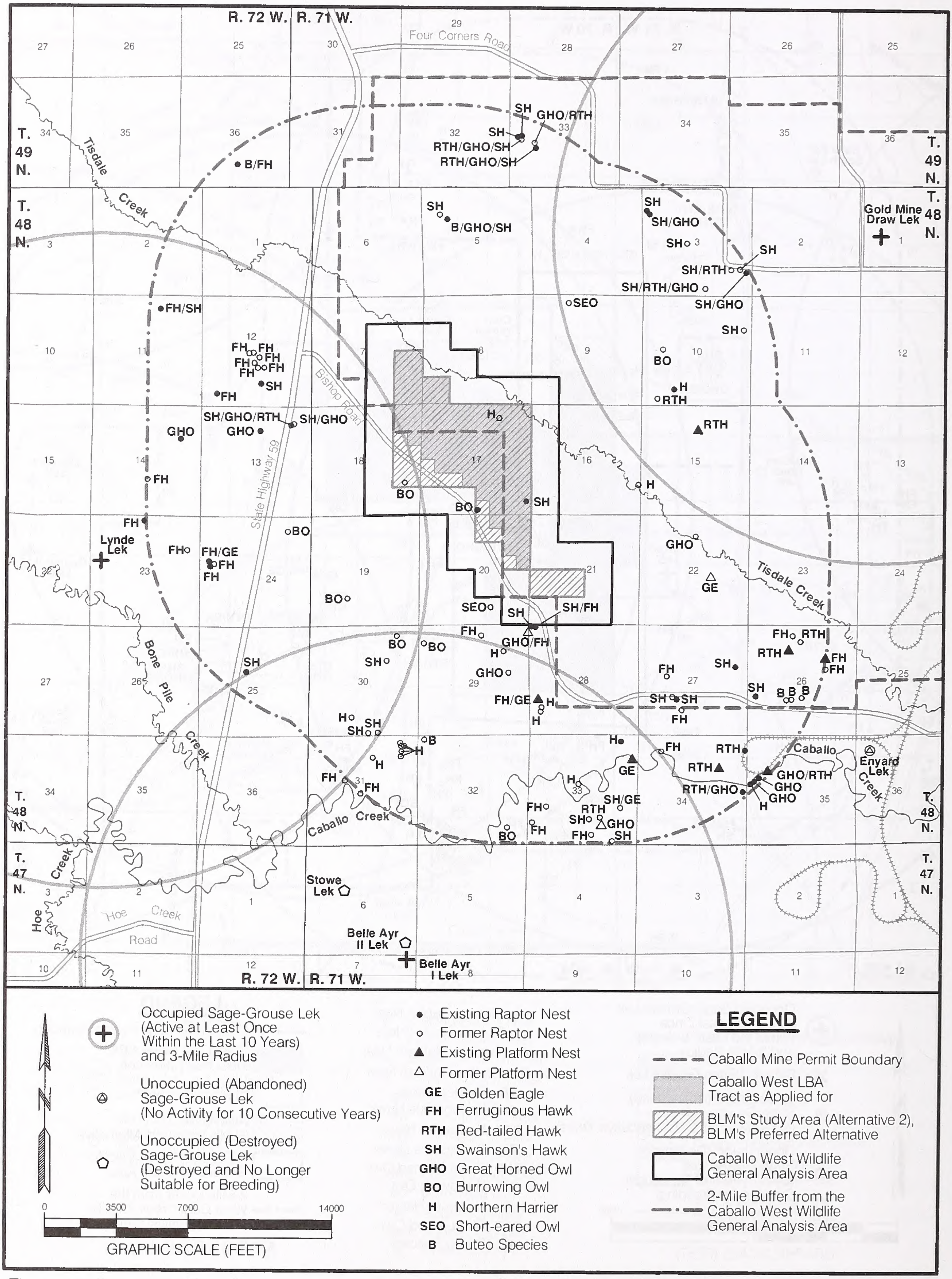


Figure 3-27. Raptor Nest Sites and Sage-Grouse Leks Within and Adjacent to the Caballo West LBA Tract.

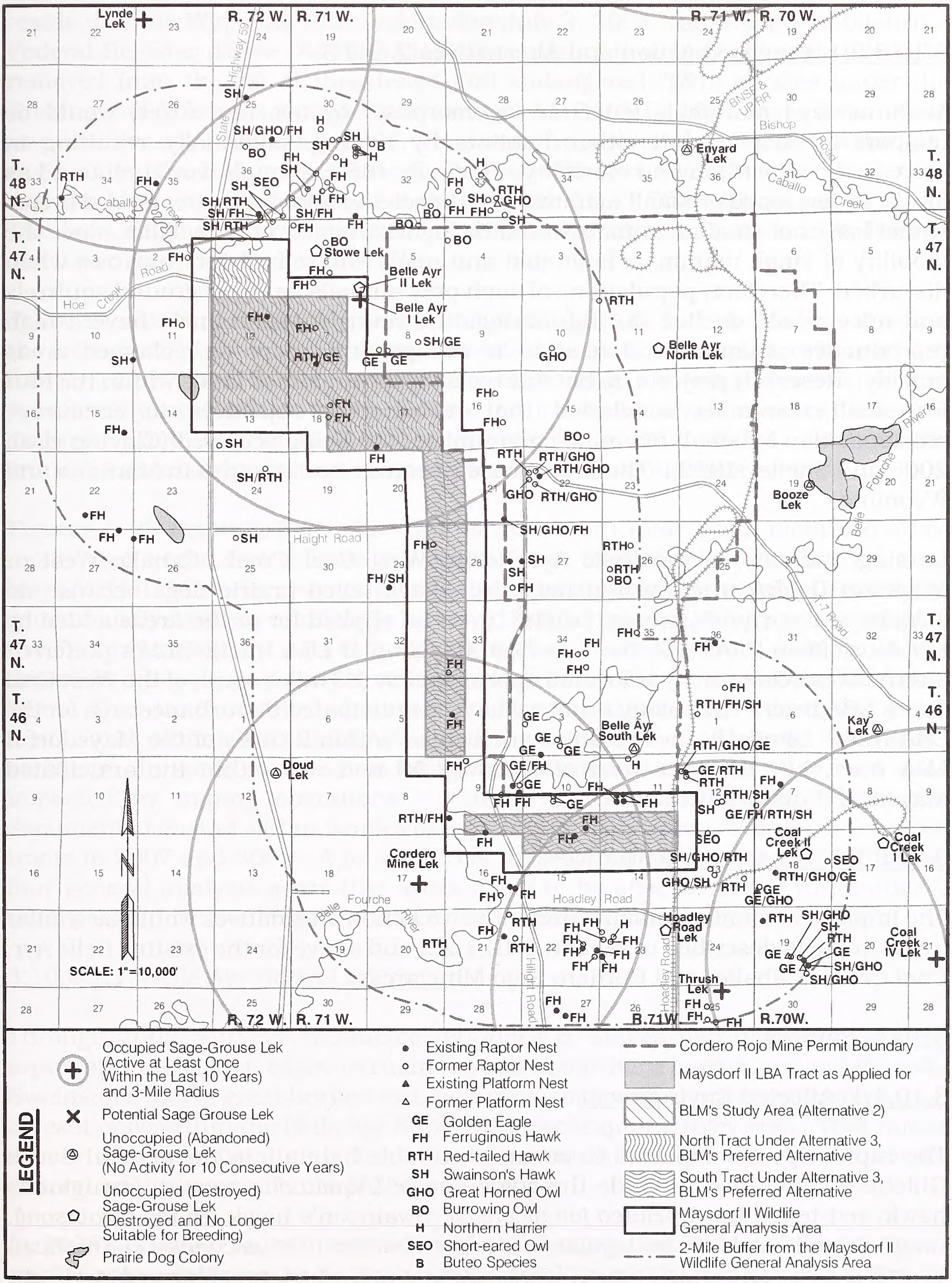


Figure 3-28. Raptor Nest Sites, Sage-Grouse Leks, and Prairie Dog Colonies Within and Adjacent to the Maysdorf II LBA Tract.

3.10.3.2 Environmental Consequences

3.10.3.2.1 Proposed Action and Alternatives 2 and 3

Medium-sized mammals (such as lagomorphs, coyotes, and foxes) would be temporarily displaced to other habitats by mining, potentially resulting in increased competition and mortality. However, these animals would rebound as forage is developed or small mammal prey species recolonize the reclaimed areas. Direct losses of small mammals would be higher than for other wildlife, since the mobility of small mammals is limited and many will retreat into burrows when disturbed. Therefore, populations of such prey animals as voles, ground squirrels and mice would decline during mining. However, these animals have a high reproductive potential and tend to re-occupy and adapt to reclaimed areas quickly. Research projects on habitat reclamation on mined lands within the PRB for small mammals concluded that reclamation objectives to encourage recolonization by small mammal communities are being achieved (Clayton et al. 2006 and Shelley 1992). Those studies evaluated sites at mines in Montana and Wyoming.

Leasing and mining the Belle Ayr North, West Coal Creek, Caballo West or Maysdorf II LBA tracts would not affect black-tailed prairie dogs because no colonies are currently present on the tracts as applied for or the areas added by the Alternative 2 (Alternative 3 for the Maysdorf II LBA tract), BLM's preferred alternatives. One colony is located approximately 1.3 miles south of the West Coal Creek LBA tract. The colony is not within the anticipated disturbance area for the LBA tract. Similarly, two colonies are located within 2 miles of the Maysdorf II LBA tract, but they are west of Highway 59 and not within the anticipated Maysdorf II disturbance area.

3.10.3.2.2 No Action Alternative

The impacts to small mammals under the No Action alternatives would be similar to the impacts described in section 3.10.1.2.2 and above for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine areas.

3.10.4 Raptors

3.10.4.1 Affected Environment

The raptor species expected to occur in suitable habitats in the general South Gillette analysis area include the golden eagle (*Aquila chrysaetos*), ferruginous hawk, red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), rough-legged hawk (*Buteo lagopus*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), prairie falcon (*Falco mexicanus*), great horned owl (*Bubo virginianus*), burrowing owl (*Athene cunicularia*), and short-eared owl (*Asio flammeus*).

The bald eagle (*Haliaeetus leucocephalus*) is a migrant and common winter resident of the Wyoming PRB region. On July 9, 2007, the USFWS published a Federal Register notice (72 FR 37346) announcing that the bald eagle would be removed from the list of threatened and endangered (T&E) species under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et* seq.); de-listing was effective as of August 8, 2007. However, the protections provided to the bald eagle under the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668, and the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703, will remain in place. The bald eagle is now recognized as a BLM Sensitive Species and is further discussed in appendix F of this EIS.

Those species that commonly nest in the general South Gillette analysis area are the ferruginous hawk, golden eagle, red-tailed hawk, Swainson's hawk, northern harrier, and great horned owl. The burrowing owl and short-eared owl occasionally nest in the area. Habitat is limited for those species that nest exclusively in trees or on cliffs, but several species have adapted to nesting on the ground, creek banks, buttes, mine highwalls, or rock outcrops.

Figures 3-25 through 3-28 show the locations of raptor nests identified since monitoring began in the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts, respectively, in the areas included in the respective wildlife general analysis areas and 2-mile buffers. There are overlaps between portions of the four raptor survey area boundaries, and as such, there are overlaps in the depiction of raptor nests on these figures and in the tract discussions that follow below. Over time, new nests have been built, natural forces have destroyed many nests, and others have been relocated for mitigation or removed by mining activities. In some cases, nests have been created to mitigate other nest sites impacted by mining operations. A total of 133 intact raptor nests were documented on and within 2 miles of the general analysis areas for these four LBA tracts in 2007 and 2008. A total of 25 of these 133 nests are located within the four general analysis areas (the areas likely to be affected under Alternative 2 (Alternative 3 for the Maysdorf II LBA tract), BLM's preferred alternatives).

<u>3.10.4.1.1 Belle Ayr North LBA Tract</u>

Through 2008, surveys conducted by Jones & Stokes had documented eight raptor species (golden eagle, ferruginous hawk, northern harrier, red-tailed hawk, Swainson's hawk, great horned owl, burrowing owl, and short-eared owl) nesting at least once within the Belle Ayr North LBA tract raptor survey area. That raptor survey area is defined as a 2-mile radius around the Belle Ayr North wildlife general analysis area (figure 3-25).

In 2008, 43 intact raptor nests were present within the Belle Ayr North raptor survey area. Only two (a Swainson's hawk and a multi-species nest) of the 38 nests intact in 2008 are located on the Belle Ayr North LBA tract as applied for under the Proposed Action. Two additional intact nest sites are present within the

Belle Ayr North wildlife general analysis area: a burrowing owl nest site and a platform nest used by ferruginous hawks and golden eagles in the past (figure 3-25). All intact raptor nests except the burrowing owl nest site are already encompassed by the existing Belle Ayr Mine permit area.

3.10.4.1.2 West Coal Creek LBA Tract

Through 2008, surveys conducted by Jones & Stokes had documented eight raptor species (golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, northern harrier, great horned owl, short-eared owl, and burrowing owl) that had nested at least once within the raptor survey area for the West Coal Creek LBA tract. That raptor survey area is defined as a 2-mile radius around the West Coal Creek wildlife general analysis area (figure 3-26). Five of those eight species have regularly nested in the raptor survey area since annual monitoring began in 1982. Northern harriers and short-eared owls are heavily dependent on cyclic small rodent populations, and their presence tends to follow peaks and valleys in those prey populations. The recent occurrence of nesting burrowing owls in the raptor survey area coincided with the re-colonization of the small prairie dog colony southeast of the tract as applied for.

Fifty-five raptor nests were intact within the raptor survey area during the 2008 breeding season. Five intact nests were on the West Coal Creek LBA tract as applied for, including one red-tailed hawk nest, one ferruginous hawk nest, one Swainson's hawk nest, and two multi-species nests (figure 3-26). Four of those five nests are also within or immediately adjacent to the existing Coal Creek permit area. No intact nests were present in lands added under Alternative 2, and only three additional nests (a ferruginous hawk, a red-tailed hawk, and a multi-species hawk nest) were within the West Coal Creek wildlife general analysis area.

3.10.4.1.3 Caballo West LBA Tract

Through 2008, surveys conducted by Jones & Stokes had documented eight raptor species (golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, northern harrier, great horned owl, short-eared owl, and burrowing owl) that had nested at least once within the wildlife survey area for the Caballo West LBA tract. That raptor survey area is defined as a 2-mile radius around the Caballo West wildlife general analysis area (figure 3-27). Of those eight species, the Swainson's hawk has been the most common nester in the raptor survey area for this tract over time. The presence of other nesting raptor species has been associated with cyclic lagomorph or small rodent populations and the availability of nest sites (e.g., intact nests of other species for great horned owls, and the presence of platform nests for ferruginous hawks and golden eagles).

In 2008, 38 intact raptor nests were present in the Caballo West raptor survey area. Two intact nests were observed in the Caballo West wildlife general analysis area (a Swainson's hawk nest on the tract as applied for and a burrowing owl nest

site on lands added under Alternative 2). The Swainson's hawk nest is within the current permit area for the Caballo mine; that nest was last active in 2002. The burrowing owl nest was active only in 1988.

3.10.4.1.4 Maysdorf II LBA Tract

Surveys conducted by Intermountain Resources documented eight raptor species (golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, northern harrier, great horned owl, short-eared owl, and burrowing owl) that had nested at least once within the wildlife survey area for the Maysdorf II LBA tract. That raptor survey area is defined as a 2-mile radius around the Maysdorf II wildlife general analysis area (figure 3-28). During surveys that were completed in 2006-2007 a total of five raptor species (golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, and great horned owl) were found to be currently nesting within the Maysdorf II survey area. In the past, the prairie falcon, northern harrier, short-eared owl, and burrowing owl have also been identified nesting within or adjacent to the survey area.

The 2008 survey identified 47 intact raptor nests in the raptor survey area. There were 12 intact nests within the Maysdorf II wildlife general analysis area including 10 ferruginous hawk nests, one red-tailed hawk/ferruginous hawk nest and one red-tailed hawk/golden eagle nest.

3.10.4.2 Environmental Consequences

3.10.4.2.1 Proposed Action and Alternatives 2 and 3

Mining the LBA tracts would not impact regional raptor populations; however, individual birds or pairs may be impacted. Mining activity could cause raptors to abandon nests proximate to disturbance. The USFWS recommends a 1-mile buffer around all ferruginous hawk nests.

3.10.4.2.1.1 Belle Ayr North LBA Tract

One intact ferruginous hawk nest (a multi-species nest) was present on the Belle Ayr North LBA tract under the Proposed Action and on lands added by Alternative 2 in 2008, and one platform nest exists at the extreme southern end of that tract's wildlife general analysis area. That platform nest is on reclamation inside the existing Belle Ayr mine permit area.

3.10.4.2.1.2 West Coal Creek LBA Tract

There are two intact ferruginous hawk nests within the West Coal Creek wildlife general analysis area; one intact ferruginous hawk nest within the West Coal Creek LBA tract under the Proposed Action. No intact nests were located in 2008 on lands added by Alternative 2. Both ferruginous hawk nests in the West Coal

Creek wildlife general analysis area have alternate nests and/or nest sites within their respective territories that are outside of the wildlife general analysis area for that tract.

3.10.4.2.1.3 Caballo West LBA Tract

No intact ferruginous hawk nests were present within the entire Caballo West wildlife general analysis area in 2008.

3.10.4.2.1.4 Maysdorf II LBA Tract

In 2008 there were 10 intact ferruginous hawk nests within the Maysdorf II wildlife general analysis area; six of these intact ferruginous hawk nests were within the Maysdorf II LBA tract under the Proposed Action. No intact nests were located on lands added by Alternatives 2 and 3.

USFWS and WDEQ/LQD approval would be required before mining would occur within buffer zones for active raptor nests. The Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines annually monitor territorial occupancy and nest productivity on and around their existing leases. Raptor nesting activity has previously occurred in active mining and construction areas. Many of those nests have succeeded due to a combination of raptors becoming acclimated to the gradual encroachment of mine operations, and successfully executed state-of-the-art mitigation techniques to maintain viable raptor territories and protect nest productivity.

Mining near raptor territories would impact the availability of native foraging habitats for nesting birds. However, equipment yards associated with mining provide additional habitat for prey species such as cottontails, and several raptor pairs voluntarily nest quite near those areas. Additionally, increased acreage of reclamation within the permit areas would offset new habitat loss as mining progresses. At surface mines throughout the region, raptor nesting efforts have typically been influenced primarily by natural factors such as prey abundance and availability of nesting substrates. Due to the paucity of woody vegetation, raptors that nest in trees or on cliffs are not as abundant as those that either nest on the ground or are adaptable to nesting on mine facilities or other man-made structures (platform nests, etc.). During mining, nesting habitat is created by the excavation process (highwalls), as well as through enhancement efforts (nest platforms, nest boxes, and tree plantings). Nests in highwalls within active mining areas, and in other areas of potential conflict, will be moved following proper permitting requirements and coordination with all corresponding agencies.

3.10.4.2.2 No Action Alternative

The impacts to raptor species for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine areas under the No Action alternatives would be similar to the impacts described in section 3.10.1.2.2.

3.10.5 Upland Game Birds

3.10.5.1 Affected Environment

Four upland game bird species are known to occur in suitable habitats in the general South Gillette analysis area. These species are sharp-tailed grouse (*Tympanuchus phasianellus*), mourning doves (*Zenaida macroura*), gray partridge (*Perdix perdix*), and Greater sage-grouse.

Based on annual lek searches since the mid 1980's, sharp-tailed grouse do not appear to be as prevalent as sage-grouse near the surface coal mines in northeast Wyoming. The nearest sharp-tailed grouse lek to the general South Gillette analysis area is the Timber Creek Lek, which is located approximately 8 miles northeast of the Caballo West wildlife general analysis area.

Mourning doves are a migrant and are relatively common in the area during spring and fall with fewer observations during the nesting season. This species is a relatively common breeding bird in Campbell County and may be found in a variety of habitat types. Doves are most often seen near sites with water sources and trees, though they are occasionally observed in sagebrush and greasewood stands. Mourning doves were common on the general South Gillette analysis area in 2006-07.

The gray partridge (a.k.a. Hungarian partridge or Hun) is an introduced, non-migratory game bird species that form flocks (or coveys) outside the breeding season. Gray partridge have been infrequently observed on reclaimed areas, sagebrush shrublands, upland grassland, and cultivated lands in the general South Gillette analysis area. In some years, this species is occasionally encountered, while in other years, partridge appear to be totally absent. Gray partridge were not observed on the general South Gillette analysis area in 2006-07.

The Greater sage-grouse, hereafter referred to as sage-grouse, is a species of concern throughout the West and is considered a "landscape species", which means that large expanses of unfragmented land are required in order to provide all the habitat components for their annual life cycle. Relying on sagebrush for food, cover, and shelter, sage-grouse require sagebrush habitat year-round and for every phase of their life cycle, and exhibit seasonal movements to utilize discrete sagebrush habitats. These movements are often in response to fidelity to seasonal use areas (breeding, nesting/brood rearing, summering, and wintering), with

adjustments related to severity of winter weather, topography, and vegetative cover.

Sage-grouse breeding occurs on strutting grounds (leks) during late March and April. Leks are generally established in open areas surrounded by Wyoming big sagebrush, which is used for escape and protection from predators. Generally, lek sites are used year after year and are considered to be the center of year-round activity for resident sage-grouse populations. On average, approximately two-thirds of sage-grouse hens nest within 3 miles of the lek where they were bred. New spring plant growth, residual cover, and understory are important habitat components for nesting sage-grouse hens.

Areas near nests are used for several weeks by hens for brood rearing. The habitats used during the first few weeks after hatching must provide good cover to conceal the chicks and must provide essential nutritional requirements during this period of rapid development. Brood-rearing habitats that have a healthy and wide diversity of plant species, particularly grasses and forbs, tend to provide a variety and abundance of insects that are an essential protein supply for the young birds.

Summer habitat consists of sagebrush mixed with areas of wet meadows, riparian, or irrigated agricultural fields. As summer progresses and forbs mature and dry up, sage-grouse broods must move to more mesic, wet meadow-type habitats where succulent plants and insects are still available. This can be especially important in drier years and during long drought periods. As the fall season nears, sage-grouse form flocks as brood groups come together. As fall progresses, sage-grouse move toward their winter ranges.

During winter, sage-grouse feed almost exclusively on sagebrush leaves and buds. Suitable winter habitat requires sagebrush above snow. It is crucial that sagebrush be exposed at least 10 to 12 inches above snow level as this provides food and cover for wintering sage-grouse. Population and habitat analyses suggest that wintering habitat can be as limiting as breeding habitats.

Sage-grouse populations are generally considered to be cyclic, with periodic intervals between peaks in region-wide male lek attendance. However, sage-grouse populations and their distribution in Wyoming have declined over the last five decades despite higher counts in some years (Jahnke 2008).

Since 1999, the USFWS has received eight petitions requesting that the sage-grouse be listed under the Endangered Species Act as threatened or endangered. Three of the petitions requested that sage-grouse be listed as endangered across its entire range. On January 12, 2005, following a 12-month status review on the species, the USFWS concluded that listing was not warranted at that time. On December 4, 2007, U.S. District Court, District of Idaho, ruled that the USFWS 12-month petition finding on sage-grouse was in error and remanded the case

back to the Service for further reconsideration. On February 26, 2008, the USFWS announced the initiation of another status review for the Greater sage-grouse.

USFWS has indicated the need for continued efforts to conserve sage-grouse and sagebrush habitat on a long-term basis, and has encouraged continued development and implementation of conservation strategies throughout the species' range. In May 2002, the USFWS office in Cheyenne, Wyoming, released a list entitled *Coal Mine List of 40 Migratory Bird Species of Management Concern in Wyoming*, which replaced the previous *Migratory Birds of High Federal Interest List*. The sage-grouse is included on the updated list, giving further impetus to ongoing annual survey efforts. The sage-grouse is also a BLM Sensitive Species and Management Indicator Species (see appendix F).

On September 11, 2003, the Wyoming Game and Fish Commission announced that the 2003 hunting season for sage-grouse in Johnson, Sheridan, and Campbell counties would be closed, following the deaths of 11 sage-grouse in northeastern Wyoming from West Nile Virus in August and early September of that year. According to WGFD's September 11, 2003 press release, the commission took this action because the incidence of infection was much higher in northeastern Wyoming than the rest of the state and the area is on the fringe of sage-grouse range with marginal, fragmented habitat. Recent lek count data indicate that Wyoming's sage-grouse populations increased slightly from 2004 through 2007. Lower incidences of West Nile Virus mortalities were also documented in those years, primarily due to cooler temperatures that reduced mosquito populations. Sage-grouse hunting seasons were consequently reopened in 2004 (Christiansen 2004).

In 2007, Wyoming Governor Dave Freudenthal commissioned a Statewide Sage-grouse Implementation Team which emerged from the Governor's 2007 Sage-Grouse Summit. On March 17, 2008, the Implementation Team preliminarily identified and mapped recommended sage-grouse core breeding areas in Wyoming in an effort to better understand what types of habitat the grouse prefer and what areas should be protected. The proximity of the SGAC tracts to these focus area is shown on figure 3-29.

On August 1, 2008, the Governor of Wyoming released an executive order regarding sage-grouse core area protection (Office of the Governor of Wyoming 2008). The sage-grouse focus area protection concept came about as a result of work by the Sage-grouse Implementation Team. The Implementation Team developed a core population strategy for the state of Wyoming "to maintain habitats and viable populations of sage-grouse in areas where they are most abundant" and delineated approximately 40 areas around the state with a focus of maintenance and enhancement of grouse habitats and populations within the focus areas. The areas were delineated by evaluating habitats within a 4-mile radius of selected sage-grouse leks in high lek-density areas. The BLM Wyoming

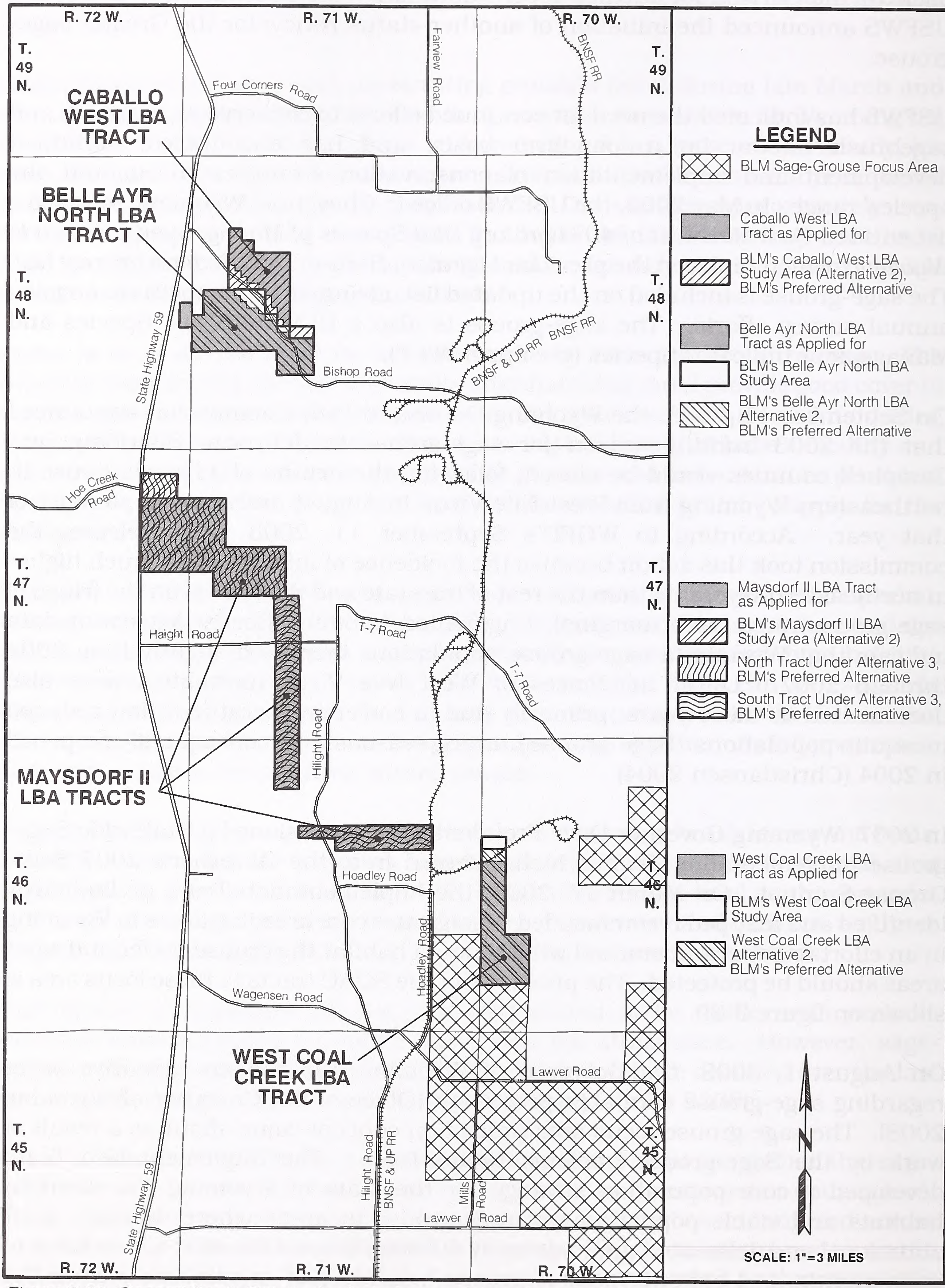


Figure 3-29. General South Gillette Analysis Area and Associated BLM Sage-Grouse Focus Areas.

State Office is in the process of developing a state-wide sage-grouse management policy and has incorporated sage-grouse focus areas based on the core area concept in the draft management policy. BLM has indicated that the sage-grouse management strategy for management of future surface disturbance (including actions proposed in this EIS) will likely be based on the sage-grouse focus areas (BLM 2008c).

WGFD has adopted definitions for the purposes of collecting and reporting sage-grouse data (WGFD 2006). The definitions contain an assessment of the annual status and a management status of sage-grouse leks. The annual status is assessed annually based on the following definitions:

- Active – Any lek that has been attended by male sage-grouse during the strutting season.
- Inactive – Any lek where sufficient data suggests that there was no strutting activity throughout a strutting season.
- Unknown – Leks for which status as active or inactive has not been documented during the course of a strutting season.

The management status is based on a lek's annual status and a lek is assigned to one of three categories for management purposes. The status of SGAC sage-grouse leks is based on the WGFD management status as follows:

- Occupied – A lek that has been active during at least one strutting season within the prior ten years. Occupied leks are protected through prescribed management actions during surface disturbing activities.
- Unoccupied (formerly "historical lek".) – There are two types of unoccupied leks, "destroyed" and "abandoned." Unoccupied leks are not protected during surface disturbing activities.
  - destroyed – A formerly active lek site and surrounding sagebrush habitat that has been destroyed and is no longer suitable for sage-grouse breeding.
  - abandoned – A lek in otherwise suitable habitat that has not been active during a period of 10 consecutive years. To be designated abandoned, a lek must be "inactive" (see above criteria) in at least four non-consecutive strutting seasons spanning the 10 years.
- Undetermined – Any lek that has not been documented active in the last 10 years, but survey information is insufficient to designate the lek as unoccupied. Undetermined leks will be protected through prescribed

management actions during surface disturbing activities until sufficient documentation is obtained to confirm the lek is unoccupied.

The Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines have conducted surveys of known sage-grouse leks and searches for new leks as part of their wildlife baseline inventories and wildlife monitoring programs since the early 1980s. Baseline inventories, which occurred prior to initial permitting and subsequent permit amendments, encompassed the respective mine's permit area and a 2-mile perimeter. The mines continued annual surveys that included the respective mine permit area and a 1-mile perimeter that began when each mine was initially permitted. Those surveys became mandatory with the implementation of Appendix B of the WDEQ/LQD Coal Rules and Regulations in 1993. Each occupied and undetermined lek is generally surveyed three times within a given breeding season. As a result, most of the general analysis areas for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts have been included in previous regular survey efforts.

Figures 3-25 through 3-28 depict the locations of sage-grouse leks identified within the 2-mile perimeter that encompasses the general analysis area for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts, respectively, in 2006 and 2007. There are overlaps between the four sage-grouse survey area boundaries, and as such, there are overlaps in the depiction of sage-grouse leks on these figures and in the tract discussions that follow below. A total of 14 sage-grouse leks have been documented on and within 2 miles of the general analysis areas for these four LBA tracts. Six of the leks have been active during recent survey years and are classified as occupied; three leks have not been attended by displaying grouse for at least the last 10 years and are classified as unoccupied/abandoned; and five leks have been removed by mining activities and are classified as unoccupied/destroyed.

There is limited potential for use of the four LBA tracts or their respective analysis areas by nesting sage-grouse hens due to the relatively small amount of nesting habitat (sagebrush) in those areas and the general paucity of sage-grouse residing there year-round.

No sage-grouse broods were recorded on any of the four LBA tracts as applied for, or on lands added under each respective Alternative 2, during specific sage-grouse surveys or surveys incidental to other species. Sage-grouse broods were recorded in 1998 and 1999 during wildlife surveys more than 2 miles southeast of the West Coal Creek LBA tract during surveys along East Fork Coal Creek. Sage-grouse broods were infrequently documented within the Belle Ayr North LBA tract general analysis area during early fall in the late 1990s. Those sightings consisted of mixed groups of female and juvenile grouse walking or feeding along the Bishop Road in the northern portion of the Belle Ayr North wildlife general analysis area. The only other sage-grouse brood recorded at any of the four wildlife general analysis areas was within the 2-mile survey perimeter of the Belle Ayr North

wildlife general analysis area. Six young upland game birds (presumed to be grouse) were seen along Caballo Creek in early May 2004, near a grouse carcass. No grouse of any age have been observed in that area since then.

Although sage-grouse may occasionally occur in the general South Gillette analysis area, it is unlikely that grouse are yearlong residents of the specific wildlife general analysis areas for any of the four proposed LBA tracts for the following reasons:

- As discussed in section 3.9, the Sagebrush/Grassland vegetation type, which is characterized by the moderate to heavy presence of Wyoming big sagebrush, occupies about 38 percent of the combined vegetation analysis areas. As indicated, that 38 percent does not represent a contiguous stand of big sagebrush, but rather is the total of all sage communities within the combined evaluation area.

- Few active leks occur within 3 miles of a given wildlife general analysis area surrounding the tracts, and many of those that are present have experienced declines in peak male attendance in recent years.

- The lands within each wildlife general analysis area have been included in annual wildlife monitoring surveys for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines for at least the last 15 years (1992-2006), and longer at some mines. No confirmed sage-grouse nests were encountered during that period.

- Specific pedestrian surveys for sage-grouse broods were conducted twice annually from 1993 through 1999 in appropriate habitat within the existing permit areas of the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines. Coincidentally, those survey routes included drainages that passed through, or were within one mile of, one or more of the proposed LBA tracts. Such surveys were no longer required by WDEQ/LQD after 1999. However, biologists watched for and recorded any sage-grouse broods seen incidental to other wildlife surveys during all subsequent monitoring years.

Although winter surveys for sage-grouse are not required as part of the annual wildlife monitoring programs for the four applicant mines, such surveys have been conducted as part of the required baseline inventories for previously planned mine expansions. Additionally, winter surveys for other species (e.g., big game, bald eagle roosts, and other wintering raptors) have been conducted at the four mines in recent years. Due to their proximity to existing mine permit areas, the general analysis areas for these four LBA tracts have been included in a minimum of seven consecutive years of big game winter surveys (from 1993 through 1999) and no sage-grouse were ever documented in or near the LBA tracts.

3.10.5.1.1 Sage-Grouse Leks Associated With the Belle Ayr North LBA Tract

No greater sage-grouse leks occur within the Belle Ayr North LBA tract as applied for, or within lands added under Alternative 2. Only one sage-grouse lek (Lynde) has been documented within 2 miles of the Belle Ayr North wildlife general analysis area during previous wildlife surveys conducted for the adjacent Belle Ayr and Caballo mines (figure 3-25). The Lynde Lek was last active in 1999. Three additional sage-grouse leks are present approximately 2.5 miles south of the Belle Ayr North wildlife general analysis area: Belle Ayr I, Belle Ayr II, and Stowe. Due to their proximity to one another, the WGFD considers all three to be within the Belle Ayr Complex. All three leks have essentially been inactive since 2004. The Bell Ayr II and Stowe leks are classified as unoccupied/destroyed. Although the Belle Ayr Complex leks themselves are beyond the 2-mile wildlife survey perimeter for the wildlife general analysis area, the 3-mile radius of concern for each lek overlaps the southern portion of the Belle Ayr North LBA tract as applied for. That radius represents the area in which two-thirds of the hens that were bred at those leks would be expected to nest.

3.10.5.1.2 Sage-Grouse Leks Associated With the West Coal Creek LBA Tract

No leks have been discovered within the West Coal Creek LBA tract as applied for or on lands added under Alternative 2 (figure 3-26). One lek site (Coal Creek II) was found within the West Coal Creek wildlife general analysis area, but has since been classified as unoccupied/destroyed. Since annual monitoring began in 1980, seven additional known or potential lek sites have been identified within the 2-mile wildlife survey area surrounding the West Coal Creek wildlife general analysis area (figure 3-26). Two known leks (Kay and Belle Fourche South) are considered unoccupied/abandoned, with no active use for at least the last 10 consecutive years (1997-2006). The Hoadley Road and Coal Creek I leks are classified as unoccupied/destroyed. The Hoadley Road Lek has not been physically disturbed but activity/disturbance is great enough in the immediate vicinity of the lek that WGFD has listed it as destroyed. The remaining three sites (Thrush, Coal Creek III, and Coal Creek IV) have also experienced lengthy periods of little or no activity over the last 10-12 years, but have not yet met the criteria (10 consecutive years) and are still officially designated as occupied. The Thrush Lek was active during only 1 of the last 10 years (1997-2006), with two males seen there in 2000. One male was seen displaying within the Coal Creek Complex (Coal Creek III and IV) during 3 of the last 10 years. Four active leks are located east of, and beyond, the 2-mile wildlife survey perimeter, but in the general vicinity of the West Coal Creek LBA tract (figure 3-26): Deaver I and II, Rough Creek I, and Flora (not shown in the figure). The leks themselves are located more than 3 miles from the West Coal Creek wildlife general analysis area. Consequently, their respective 3-mile radii do not overlap the tract itself (as applied or lands added under Alternative 2). However, the 3-mile radii of concern for all four leks do overlap the eastern third of the 2-mile wildlife survey area (figure 3-26). Of those four sites, the Rough Creek I Lek has been the most active

over time, with males observed every year since monitoring began in 1980. That lek is part of the five-lek Rough Creek Complex, which has been visited by up to 300 grouse (males and hens) in a given year. The Deaver Lek was discovered in 1989, and has gone through varying degrees of activity since then, including a shift in location that occurred in 2006. The Flora Lek is on private lands northeast of the West Coal Creek wildlife general analysis area; lands that have not been consistently accessible for monitoring. The lek was known to be active as recently as 2001, but accurate records for the last 10 years are not available.

Annual monitoring efforts conducted at the adjacent Coal Creek Mine since the early 1980s, which overlapped the LBA tract and its two-mile perimeter, have demonstrated that sage-grouse use has been concentrated approximately 4 to 5 miles east of the tract. It is unlikely that sage-grouse are regular yearlong residents in the West Coal Creek LBA tract (including Alternative 2 lands) or its two-mile perimeter due to area being dominated by a grassland vegetation type and not sagebrush. A more detailed discussion regarding sage-grouse use of the West Coal Creek LBA tract is included in the SGAC EIS Supplementary Information document, which is available on request.

3.10.5.1.3 Sage-Grouse Leks Associated With the Caballo West LBA Tract

No sage-grouse leks have ever been documented on or within 2 miles of the Caballo West wildlife general analysis area. Four greater sage-grouse leks (Belle Ayr I, Belle Ayr II, Lynde, Stowe) were found within 3 miles of the Caballo West wildlife general analysis area during previous studies conducted for the adjacent Caballo and Belle Ayr mines. The Belle Ayr II and Stowe leks are classified as unoccupied/destroyed. The other two leks have essentially been inactive since at least 2004. The Gold Mine Draw Lek is located just outside of this 3-mile radius. The 3-mile radius around the Lynde Lek overlaps the west-central portion of the Caballo West LBA tract as applied for, as well as lands added under Alternative 2 and the Caballo West wildlife general analysis area in that region (figure 3-27). The 3-mile radius the Belle Ayr I Lek falls just outside of that perimeter. The 3-mile radius for the Gold Mine Draw Lek does not intersect the Caballo West wildlife general analysis area, but does overlap the 2-mile wildlife survey area for the Caballo West LBA tract.

3.10.5.1.4 Sage-Grouse Leks Associated With the Maysdorf II LBA Tract

No leks have been discovered within the Maysdorf II LBA tract as applied for or on lands added under Alternatives 2 and 3 (figure 3-28). Two leks (Belle Ayr I and II) have been documented within the wildlife general analysis. Seven other sage-grouse leks have been documented within 2 miles of the Maysdorf II wildlife general analysis area: the Stowe, Doud, Belle Fourche South, Cordero Mine, Thrush, Hoadley Road, and Coal Creek II leks. The Belle Ayr I, Cordero Mine, and Thrush are classified as occupied. The Doud and Belle Fourche South leks are classified as unoccupied/abandoned and the Stowe, Belle Ayr II, Hoadley Road

and Coal Creek II leks are classified as unoccupied/destroyed. The Hoadley Road Lek has not been physically disturbed but activity/disturbance is great enough in the immediate vicinity of the lek that WGFD has listed it as destroyed. The Belle Ayr I and Belle Ayr II Belle Ayr leks are two nearly contiguous areas where sage grouse were observed strutting within the wildlife general analysis area. The peak number of males observed at the two leks was 12 in 1991, while no males were recorded in surveys conducted in 1992, 1993, 2004, 2006 or 2007. One male was recorded on the Belle Ayr I/II leks in 2005. Attendance has been relatively low, averaging less than four males over the last 18 years. The Stowe Lek is located approximately 0.4 mile north of the wildlife general analysis area. The Stowe Lek had a peak of eight males in 2001, but no birds were recorded on this lek in 2003, 2004, 2005, 2006, or 2007. Due to their proximity to one another, the WGFD considers the Belle Ayr I, Belle Ayr II and Stowe leks to be within the Belle Ayr Complex. The Thrush Lek is located over 1.5 miles southeast of the Maysdorf II wildlife general analysis area. The Thrush Lek was not active in 1995 through 1999 and 2001 through 2007. The peak number of males observed on the Thrush Lek was 19 (1990 and 1991). The Cordero Mine Lek is located approximately 0.5 mile from the southwest corner of the wildlife general analysis area. A maximum of seven males were recorded at the Cordero Mine Lek in 2003, but no birds were in attendance in 2004, 2005, 2006, or 2007. The Lynde Lek is located approximately 2.9 miles northwest of the wildlife general analysis area and its 3-mile radius just intersects the northwest corner of the analysis area. The 3-mile radii around the Belle Ayr I, Thrush, and Cordero Mine leks also extend onto the Maysdorf II wildlife general analysis area (figure 3-28).

3.10.5.2 Environmental Consequences

3.10.5.2.1 Proposed Action and Alternatives 2 and 3

Leasing and mining the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts would affect potential habitat for mourning doves, sharp-tailed grouse, and gray partridge; however, the tracts do not provide unique habitat for these species. Sightings of sharp-tailed grouse and gray partridge are infrequent in this area.

Overall, the sage-grouse population has been steadily declining in Wyoming and across the rest of the west. A study prepared by the Western Association of Fish and Wildlife Agencies estimated that sage-grouse populations in western North America declined at an overall rate of 2.0 percent per year from 1965 to 2003 (Connelly et al. 2004). The decline rate was greater from 1965 to 1985, with populations stabilizing and some increasing from 1986 to 2003. For Wyoming, this study estimated that sage-grouse populations declined at an average rate of 9.66 percent from 1968 to 1986 (0.51 percent per year), and at an average rate of 0.33 percent per year from 1987 to 2003. Population lows were reached in the mid-1990s and there has been some gradual increase in numbers since that time (Connelly et al. 2004).

The Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts are within the Northeast Wyoming Local Sage-Grouse Working Group (NWLSWG) area, which includes portions of the WGFD Sheridan and Casper regions and the Thunder Basin National Grassland, which is located south of the general South Gillette analysis area. Sage-grouse monitoring has occurred within the NWLSWG area since 1967. Within this area, sage-grouse population trends have exhibited a cyclical pattern, although the overall trend indicates declining numbers since at least 1967 (figure 3-30).

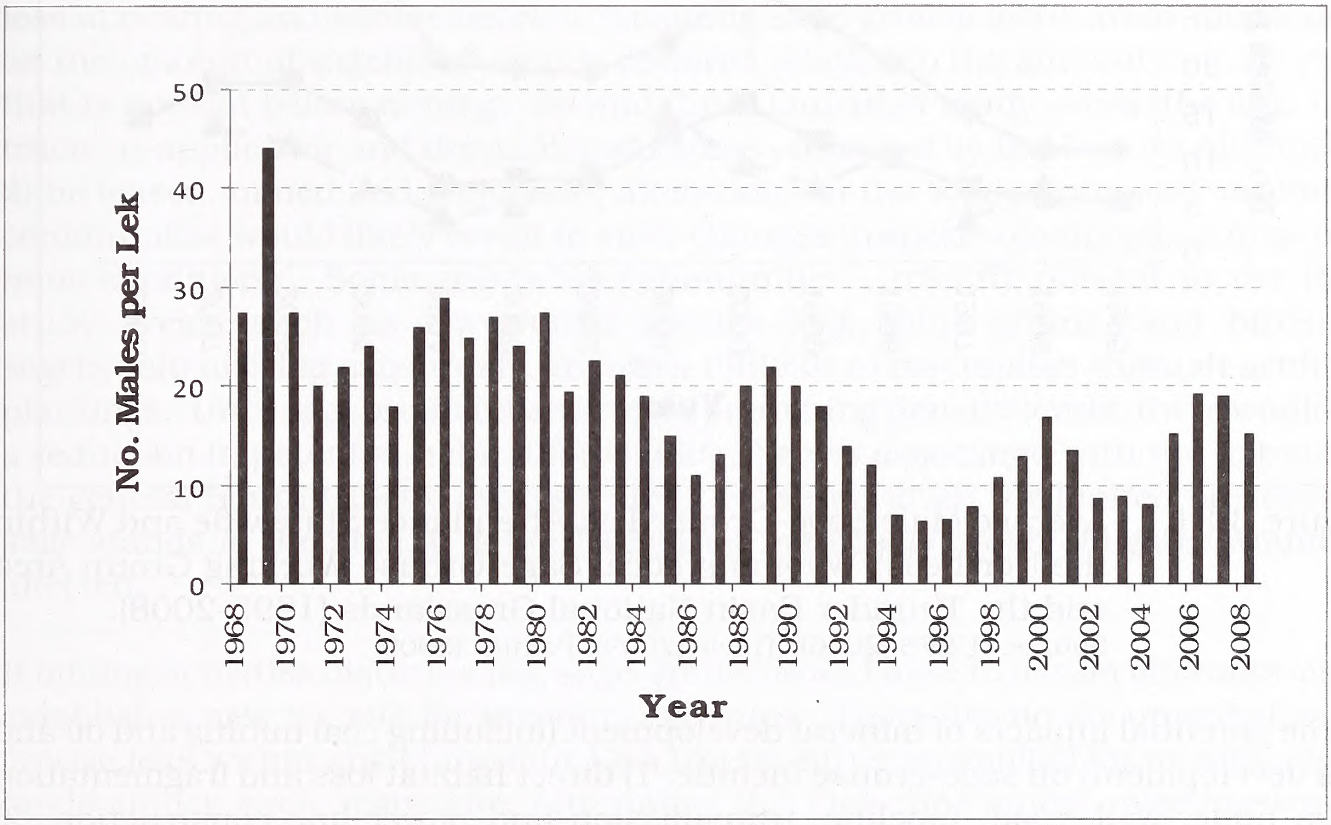


Figure 3-30. Average Male Sage-Grouse Lek Attendance Within the Northeast Wyoming Local Working Group Area (1968-2008).
Source: USFS (2006), Thiele (2009)

Population trends within the NWLSWG appear to be mirroring statewide trends in Wyoming, although the average number of males per lek in the NWLSWG Area, including in the Thunder Basin National Grassland, has typically been lower than those observed state wide (figure 3-31). Since 1996, sage-grouse populations within the state and in northeast Wyoming have fluctuated but exhibited an overall increase, with a recent peak in male lek attendance occurring in 2006.

The causes of the range-wide decline in sage-grouse population levels are not completely understood, but they may be influenced by local conditions. However, habitat loss due to disturbance of leks, nesting and brood-rearing areas as a result of increasing development, drought, and the potential for West Nile virus, as well as loss of population connectivity are key threats to this species (Naugle et al. 2004).

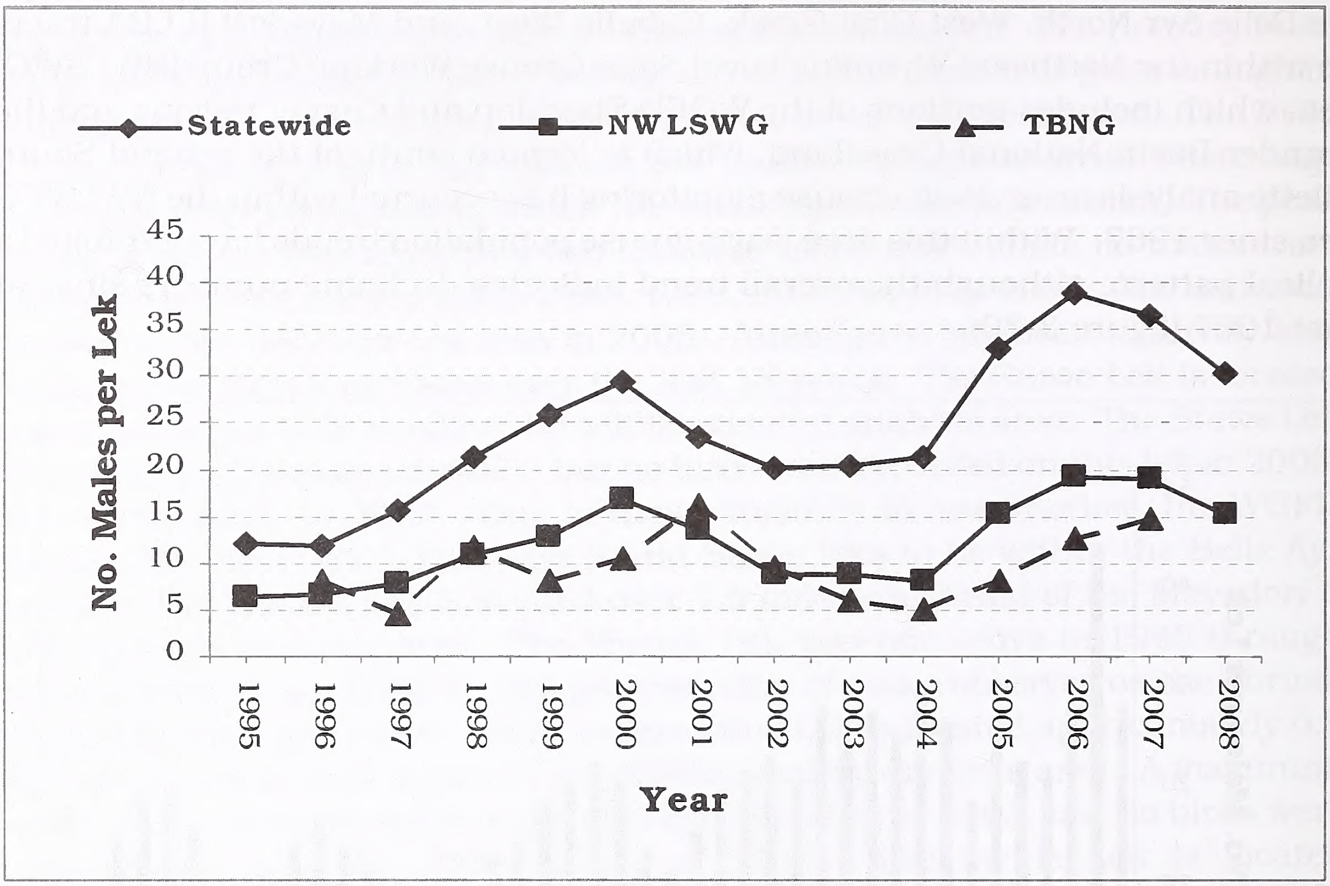


Figure 3-31. Average Male Sage-Grouse Lek Attendance Statewide and Within the Northeast Wyoming Local Sage-Grouse Working Group Area and the Thunder Basin National Grasslands (1995-2008).
Source: USFS (2006), Thiele (2009), Painter (2009)

Some potential impacts of mineral development (including coal mining and oil and gas development) on sage-grouse include: 1) direct habitat loss and fragmentation from mine, well, road, pipeline, transmission and power line construction, 2) alteration of plant and animal communities, 3) increased human activity which could cause animals to avoid the area, 4) increased noise, which could cause animals to avoid an area or reduce their breeding efficiency, 5) increased motorized access by the public leading to legal and illegal harvest, 6) direct mortality associated with water evaporation ponds and production pits, and 7) reduced water tables resulting in the loss of herbaceous vegetation. Some impacts may be long-term (30 years or more), and rehabilitation of impacted habitats may take many years to complete (WGFD 2003). In the case of sage-grouse lek attendance near the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines, the decline in attendance preceded physical mining disturbance and thus may not be attributable to mine-related activities (Orpet 2007, TJS 2007).

Areas of suitable habitat for nesting and strutting grounds are needed to sustain sage-grouse populations. One recent study suggests that availability of winter habitat may also affect sage-grouse populations (Naugle et al. 2006). The Sage-Grouse Implementation Team has delineated sage-grouse focus areas within Wyoming and a portion of the West Coal Creek LBA tract is adjacent to one of

these focus areas (figure 3-29). According to the Implementation Team, development could occur within the sage-grouse core areas "when it can be demonstrated that the activity will have no negative effects on Sage-grouse, using a case-by-case localized approach and appropriate ground-truthing" (Sage-Grouse Implementation Team 2008).

During mining, there is a short term loss of potential nesting habitat and potential disturbance to breeding activities, especially when mining operations occur in proximity to sage-grouse leks. Following reclamation, there may be a long term loss of nesting and winter habitat, including sage-grouse focus areas, depending on the amount of sagebrush that is restored relative to the amount of sagebrush that is present before mining. Should these four BLM study areas (the four LBA tracts as applied for and the additional areas evaluated by BLM under Alternative 2) be leased, mined and reclaimed, alterations in the topography and vegetative communities would likely result in such changes in species composition from pre-mine conditions. Some vegetative communities currently present in the BLM study areas, such as low-growth species (e.g., blue grama, and birdsfoot sagebrush) and big sagebrush, are often difficult to reestablish through artificial plantings. Until sagebrush returns to its premining density levels, there would be a reduction in potential habitat for wildlife species associated with the habitat in the general South Gillette analysis area. However, given the limited presence of sage stands in the area, it is not likely that many sagebrush obligates would be affected.

If mining activities disturb a lek, sage-grouse would have to use an alternate lek or establish a new lek site for breeding activities. There are no documented sage-grouse leks within any of the four LBA tracts, either as applied for or with added lands under each respective Alternative 2. Only one unoccupied/destroyed (inactive 10 or more consecutive years) lek has ever been documented within the specific wildlife general analysis areas: the Coal Creek III Lek in the West Coal Creek LBA tract. Fidelity to lek sites has been well documented in the region as a whole (WGFD 2003), but monitoring of sage-grouse activities has indicated that the birds may change lek sites within a given complex.

As discussed in section 3.10.5.1, 15 known or potential sage-grouse leks have been identified in the combined evaluation area (2-mile buffer areas) for the four LBA tracts analyzed in this EIS (figures 3-25 through 3-28). Seven of the 14 leks are classified by the WGFD as occupied, four are classified as unoccupied abandoned, and four are classified as unoccupied/destroyed. Five other known or potential leks with recent activity are all more than 2 miles from the specific wildlife general analysis area of each LBA tract. However, the 3-mile radii of concern for those five leks overlap one or more LBA tracts or tract wildlife general analysis areas. The 3-mile radius is the area in which two-thirds of the hens that were bred at those leks would be expected to nest. If the LBA tracts and/or added lands are leased and mined, potential nesting habitat for grouse that were bred at those leks would be affected by mining activity in those areas. However, as also

previously discussed, no sage-grouse nests or broods have been recorded on any of the four LBA tracts as applied for or on lands added under each respective Alternative 2, during specific surveys or incidental to other wildlife surveys conducted in those areas annually since at least 1994. The noise associated with mining operations may also disrupt sage-grouse breeding and nesting activities that might occur in those areas.

There is some evidence that sage-grouse populations do repopulate areas after reclamation for the species, but there is no evidence that populations attain their previous levels and reestablishment in reclaimed areas may take 20 to 30 years, or longer (Braun 1998). Estimates for the time it would take to restore shrubs, including sagebrush, to premine density levels range from 20 to 100 years, which may delay sage-grouse repopulation in the reclaimed areas.

3.10.5.3 No Action Alternative

Impacts to upland game birds under the No Action alternative would be similar to the impacts described in section 3.10.1.2.2.

3.10.6 Other Birds

3.10.6.1 Affected Environment

USFWS uses a list entitled *Migratory Bird Species of Management Concern in Wyoming*, specifically the *Coal Mine List of 40 Migratory Bird Species of Management Concern in Wyoming*, for reviews related to existing and proposed coal mine leased land (USFWS 2002). This list was taken directly from the Wyoming Bird Conservation Plan (Cerovski et al. 2001), and was current through 2006. The *Migratory Bird Species of Management Concern in Wyoming* list replaced the *Migratory Birds of High Federal Interest* list. All four mines have conducted specific surveys for migratory birds of concern annually since at least 1993, incorporating new lists and survey protocols as they were issued. The surveys, which are conducted in the spring and summer, include the existing permit area and a ½-mile perimeter (1-mile perimeter for bald eagles).

Due to the proximity of the proposed LBA tracts (including added lands and respective wildlife general analysis areas) to existing mine permit areas, a significant portion of all four LBA tracts has been included in annual surveys for avian species of concern since 1993. Results from surveys for migratory birds at the four applicant mines are available in baseline and annual wildlife reports, on file with WDEQ/LQD. Those reports include a tabulation of the regional status, expected occurrence, historical observations, and breeding records for each species on the current list of avian species of concern for a given report year, as well as two or more preceding years. Additional information for each species observed within the given year is provided in the text of those reports.

The Wildlife Section of the supplemental information document to this EIS, which is available on request, includes a tabulation of the regional status and expected occurrence, historical observations, and breeding records for each of the species on the *Coal Mine list of 40 Migratory Bird Species of Management Concern in Wyoming*, based on a compilation of the results of the annual surveys conducted on and near the respective LBA tracts (as applied for and added lands). Twenty-three of the 40 listed species have historically been observed within the combined evaluation area for the four proposed LBA tracts. Species that historically have been recorded, or are suspected of, nesting in the area include the burrowing owl, Brewer's sparrow (*Spizella breweri*), Swainson's hawk, short-eared owl, ferruginous hawk, lark bunting (*Calamospiza melanocorys*), grasshopper sparrow (*Ammodramus savannarum*), upland sandpiper (*Bartramia longicauda*), loggerhead shrike (*Lanius ludovicianus*), lark sparrow (*Chondestes grammacus*), sage thrasher (*Oreoscoptes montanus*), chestnut-collared longspur (*Calcarius ornatus*), McCown's longspur (*Calcarius mccownii*), greater sage-grouse, and the vesper sparrow (*Pooecetes gramineus*). Other species documented less often in the area include the peregrine falcon (*Falcon peregrinus*), bald eagle, bobolink (*Dolichonyx oryzivorus*), common loon (*Gavia immer*), long-billed curlew (*Numenius americanus*), red-headed woodpecker (*Melanerpes erthrocephalus*), sage sparrow (*Amphispiza belli*), and merlin (*Falco coumbarius*). The bald eagle is only observed in the winter or as a migrant. The other non-nesting species have been observed infrequently as migrants.

The mountain plover is included on the list of *Coal Mine list of 40 Migratory Bird Species of Management Concern in Wyoming*. The USFWS proposed listing the mountain plover as a threatened species in February 1999 but in September 2003 the agency withdrew the proposed rule to list the mountain plover as threatened (USFWS 2008). The USFWS continues to encourage provisions that would provide protection for this species, as it continues to be protected under the Migratory Bird Treaty Act and as a sensitive species under BLM policy (Bureau Manual 6840.06 E. Sensitive Species).

Wildlife surveys conducted at the Belle Ayr, Coal Creek, and Cordero Rojo mines have failed to detect the presence of this species in their respective survey areas. The survey areas, which include the mines' permit areas and a half-mile perimeter, are inventoried for suitable mountain plover habitat annually. Only a single observation of mountain plovers has been reported in the vicinity of the Caballo West LBA tract. In August 1992, a migrant flock of 12 individuals was seen in saline grassland habitat within the LBA tract as applied for. No plovers have been documented in that area or elsewhere in the general South Gillette analysis area during the subsequent 14 years (through 2006) of annual monitoring.

The bald eagle is seasonally common and most frequently observed during the winter months. Bald eagles are relatively common winter residents and migrants in northeastern Wyoming's PRB. No bald eagle roosting habitat is present on the

Belle Ayr North, Caballo West, or Maysdorf II LBA tracts or areas added by the other alternatives. No bald eagle winter roosts have ever been documented in or within one mile of either the Belle Ayr North or Caballo West wildlife general analysis areas. Potential winter roosting habitat for this species is present, but limited, in the vicinity of the West Coal Creek and Maysdorf II LBA tracts and adjacent lands. The West Coal Creek habitat consists of a relatively sparse cottonwood corridor along East Fork Coal Creek in the east-central portion of the LBA tract as applied for, and other isolated trees in that general area. Potential winter roosting habitat is located approximately ¾-mile east of the Maysdorf II tract. No known nest sites, or consistent yearly concentrated prey or carrion sources for bald eagles are present in the vicinity of the Belle Ayr, Coal Creek, or Caballo mines, including the LBA tracts and their adjacent lands. However, a sheep ranching operation is located just west of the Maysdorf II LBA tract as applied for, on the north side of Haight Road. Eagles may feed or scavenge upon adult sheep carcasses in this area in the winter, although that source of food would not be consistent or abundant, and wintering migrant eagles have typically left the area prior to spring lambing season.

In the winters of 2004-2005, 2005-2006, and 2006-2007, the bald eagle has been far more common and abundant in the area than in previous years. This may have been a result of mild winters and the abundance of lagomorphs (rabbits) to prey upon. Bald eagles also scavenged road-killed rabbits off of adjacent roads. Lagomorph numbers appeared to be at or near a peak in their cycle during those years. During those three winters, bald eagles frequently used a large windbreak within the existing Cordero Rojo Mine permit area approximately ¾- mile east of the Maysdorf II tract. Bald eagles had never been observed concentrating in this windbreak during the previous 25+ years of wildlife surveys. A maximum of 29 bald eagles were observed at this roost site on February 16 of 2005 with maximums of 20 and 15 recorded in 2005-2006 and 2006-2007, respectively. Very few birds had been observed at the roost site through late 2007. This roost site is within ¼-mile of active mining operations and bald eagles were commonly observed around mining activities. The only winter roost site documented in the vicinity of the West Coal Creek LBA tract since 1980 was recorded during February 2007, when two to three adult bald eagles were observed perched in the same mature cottonwood on three different occasions. That tree is located within the LBA tract as applied for and immediately south of the current Coal Creek Mine permit area.

The burrowing owl is uncommon and is observed as an occasional breeder in the combined evaluation area. Sage-grouse, recently added to the Level I list of avian species of concern at coal mines, are becoming less common in the general South Gillette analysis area but are still classified as a common breeder on and within 4 miles of the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II LBA tracts (see section 3.10.5 above). The USFWS considers Level I species as in need of conservation action, which includes having a monitoring and mitigation plan for those birds.

Suitable nesting habitat is scarce if not absent in the general South Gillette analysis area for the remainder of the *40 Migratory Bird Species of Management Concern in Wyoming*; therefore, the other species have rarely or never been recorded.

Under natural conditions, the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II LBA tracts and adjacent lands provide limited waterfowl and shorebird habitat. The natural aquatic habitat, prior to CBNG development within the Belle Fourche River drainage basin, was mainly available during spring migration as ponds (primarily stock reservoirs and playa areas) and intermittent and ephemeral streams. Many of these water features generally got quite low or dried up during the summer. However, the relatively recent development of CBNG resources upstream and within the wildlife general analysis area has supplied the river, its tributaries, ponds, and playas with water nearly continuously, resulting in an increase in habitat for waterfowl and shorebird species. Broods of Canada geese (*Branta Canadensis*) American wigeon (*Anas Americana*), blue-winged teal (*Anas discors*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), gadwall (*Anas strepera*), and green-winged teal (*Anas crecca*) were observed during 2005 and/or 2006 throughout the area.

3.10.6.2 Environmental Consequences

3.10.6.2.1 Proposed Action and Alternatives 2 and 3

Of the 23 *Migratory Bird Species of Management Concern* for Wyoming coal mines that have historically been observed in the wildlife general analysis area, the Level I species (those identified as needing conservation action) that have historically been recorded nesting in the area include the ferruginous hawk, burrowing owl, greater sage-grouse, Brewer's sparrow, Swainson's hawk, and McCown's longspur. Level I species that do not have abundant nesting habitat available in the wildlife general analysis areas, but have been documented or presumed to nest, include the short-eared owl and upland sand piper. Other Level I species observed in the area include the peregrine falcon, long-billed curlew, sage sparrow, and bald eagle, with varying degrees of frequency.

The existing habitat for these species on the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II LBA tracts and their respective wildlife general analysis areas (tracts as applied for, added lands, and a one-quarter-mile perimeter around that combined area) would be destroyed during mining. The habitat loss would be short-term for grassland species, but would last longer for shrub-dependent species. There are currently no trees on three of the four LBA tracts (as applied for and with added lands). The West Coal Creek LBA tract and its wildlife general analysis area do support scattered trees along the primary drainages in that location. Current reclamation practices at the applicant mines are designed to provide a mosaic of upland grass and sagebrush habitats that would potentially host most of these species. Periodic breeding bird surveys at

other surface mines with similar habitats in the region since the mid-1980s have demonstrated that species richness and abundance in reclaimed habitats are equal to or greater than in their native counterparts, though species composition may not be the same due to differences between pre- and post-mining vegetation. Additionally, surface coal mines in the PRB of northeastern Wyoming are required to replace each tree lost to mining, though it will take many years for newly planted trees to reach maturity. Research projects on habitat reclamation on mined lands within the PRB for small mammals and birds concluded that the diversity of song birds on reclaimed areas was less than on adjacent undisturbed areas, although their overall numbers were greater (Clayton et al. 2006 and Shelley 1992).

No impacts to mountain plovers are anticipated because they have only been observed one time in the last 14 years at or near any of the four LBA tracts, despite annual monitoring in those areas every year since the lone observation was recorded (1992). Additionally, the typical suitable habitat for this species is not currently present on the tracts.

Potential impacts to the bald eagle, sage-grouse and other raptors in general, as well as measures in place to prevent impacts to these species from existing mining operations are included in the preceding discussions, in appendix E, or the Supplementary Information document (available on request).

Mining the LBA tracts would have a negligible effect on migrating and breeding waterfowl and shorebirds. Sedimentation ponds created during mining would provide interim habitat for these fauna. Cordero Rojo Mine's current reclamation plan requires that the portion of the Belle Fourche River channel affected by currently permitted mining be reclaimed to restore its premining functions and aquatic habitats. Similar requirements would be put into place whenever primary channels are diverted for mine operations at other properties. The Belle Fourche River diversion channel and other future diversions would not provide the same habitat as the natural channels, although natural stream flow and the presence of CBNG discharge water would not be affected. If the Maysdorf II LBA tract is leased and mined, current reclamation efforts would be extended onto the portion of the river affected by mining the tract. Replacement of all impacted jurisdictional wetlands would be required in accordance with Section 404 of the Clean Water Act (section 3.7) for all four tracts, as applicable. If the replaced wetlands on the LBA tracts do not duplicate the exact function and/or landscape features of the pre-mine wetlands, waterfowl and shorebirds could be beneficially or adversely affected as a result.

3.10.6.2.2 No Action Alternative

Impacts to migratory bird species, waterfowl, and shorebirds under the No Action alternatives would be similar to the impacts described in section 3.10.1.2.2 and

above for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine areas.

3.10.7 Amphibians, Reptiles, and Aquatic Species

3.10.7.1 Affected Environment

Wildlife surveys completed specifically for the applicants and adjacent mines, as well as biological research projects in the eastern PRB, have documented numerous other wildlife species that inhabit the region, including various amphibians, reptiles, and aquatic species. All these species are generally common inhabitants of the general South Gillette analysis area.

Numerous reptile and amphibian species have been recorded during the various surveys on the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine areas and adjacent lands, including the specific wildlife general analysis areas. These species include the tiger salamander (*Ambystoma tigrinum*), plains spadefoot (*Scaohiopus bombifrons*), great plains toad (*Bufo cognatus*), Woodhouse's toad (*Bufo woodhousei*), boreal chorus frog (*Pseudacris triseriata maculata*), northern leopard frog (*Rana pipiens*), common snapping turtle (*Chelydra serpentina*), western painted turtle (*Chrysemys picta belli*), eastern short-horned lizard (*Phrynosoma douglassi brevirostre*), northern sagebrush lizard (*Sceloporus graciosus graciosus*), prairie rattlesnake (*Crotalus viridis viridis*), plains hognose snake (*Heterondon nasicus nasicus*), bullsnake (*Pituophis melanoleucas sayi*), western plains garter snake (*Thamnophis radix haydeni*), red-sided garter snake (*Thamnophis sirtalis parietalis*), and eastern yellowbelly racer (*Coluber constrictor flaviventris*). The abundance of these reptiles and amphibians is difficult to determine but these species appear to be common to the area.

Under natural conditions, aquatic habitat is limited by the temporary nature of most surface waters in the combined evaluation area. The lack of deep-water habitat and extensive and persistent water sources within that region limits the presence and diversity of fish and other aquatic species.

3.10.7.1.1 Belle North LBA Tract

The scarcity of mesic habitats throughout the majority of the Belle Ayr North wildlife general analysis area reduces the potential of the area to attract aquatic species. The adjacent Belle Ayr Mine has conducted a voluntary program of aquatic monitoring on Caballo Creek (south of the LBA tract) twice annually from fall 1986 through fall 1999, and in alternate years from 2001-2006. Those surveys were expanded in 2006 to include a new diversion on the creek. Caballo Creek has demonstrated characteristics of both an ephemeral and intermittent stream. Some stream segments flow only in response to snowmelt runoff in the spring and thunderstorm runoff in the summer months, although there are some stream segments that flow throughout the year in response to alluvial

groundwater discharge. Recent influxes of CBNG discharge water into the creek have provided extended periods of surface water in some, but not all, of the last few years. During 2006, several fish were documented in stretches of Caballo Creek, including the sand shiner (*Notropis stramineus*), fathead minnow (*Pimephales promelas*), green sunfish (*Lepomis cyanellus*), and bluegill (*Lepomis macrochirus*). Despite the presence of these species, Caballo Creek is not considered a viable fishery.

3.10.7.1.2 West Coal Creek LBA Tract

Coal Creek and its various tributaries associated with the West Coal Creek wildlife general analysis area have not historically exhibited flow persistent enough to warrant aquatic sampling. Nevertheless, limited fisheries sampling was conducted during the baseline studies for the Coal Creek Mine in three stock ponds within the existing permit area in 1975. The nearest survey site during those efforts was a pond located approximately one mile east of the LBA tract as applied for. The common fathead minnow (*Pimephales promelas*) was the only species captured at the pond. No specific sampling was required or conducted for herptiles or aquatic species during the West Coal Creek LBA tract baseline studies. Nevertheless, biologists watched for and recorded all incidental sightings of those animals during each site visit.

3.10.7.1.3 Caballo West LBA Tract

Monitoring of aquatic species is not regularly conducted at the Caballo Mine, and fish surveys were not required or conducted specifically for the Caballo West LBA tract. The nearest regular monitoring of aquatic species occurs as part of regular surveys in Caballo Creek, south of the Caballo West LBA tract, for the neighboring Belle Ayr Mine. All baseline and annual report documents for the Caballo and Belle Ayr mines are on file with WDEQ/LQD in Sheridan, Wyoming.

3.10.7.1.4 Maysdorf LBA II Tract

Fish surveys were conducted in the Belle Fourche River during baseline studies for the Cordero Rojo Mine in 1975 and on the Maysdorf LBA II Tract in 2005. These surveys were completed in the southern and southeastern portion of the existing Cordero Rojo Mine area in 1975 and throughout the Maysdorf LBA II Tract in 2005. Fish species observed during those surveys include the common carp (*Cyprinus carpio*), creek chub (*Semotilus atromaculatus*), flathead chub (*Platygobio gracilis*), sand shiner, brassy minnow (*Hybognathus hankinsoni*), fathead minnow, white sucker (*Catostomus commersoni*), black bullhead (*Ameiurus melas*), green sunfish, and yellow perch (*Perca flavescens*). The most abundant fish were the white sucker and various minnow species.

In 1997, the Belle Fourche River was sampled at a location several miles upstream from the Maysdorf II LBA tract. The black bullhead, creek chub, carp, fathead

minnow, green sunfish, sand shiner, and white sucker were found during those surveys (Patton 1997). WGFD has categorized the black bullhead as a Status 3 species. Status 3 species are widely distributed throughout their native range with stable populations; however, habitat is declining or vulnerable.

Excluding the black bullhead, none of the other aquatic species found during the 1975, 1997, or 2005 surveys are of specific concern to state or federal agencies and the Belle Fourche River channel through the Maysdorf II LBA tract is not considered a viable fishery. The site rating for this stream reach was poor to very poor, based on the 2005 macroinvertebrate samplings and the WDEQ Indices.

As discussed above, water discharged from CBNG wells has recently supplied the Belle Fourche River and some tributaries, ponds, and playas with water nearly continuously, resulting in an increase in habitat for aquatic species. However, in July of 2005 only 40 percent of the river's channel length through the Maysdorf II LBA tract contained water, while the remaining 60 percent of the channel length was dry. These observations document that this reach of the Belle Fourche River has not become perennial, even with the addition of CBNG discharge water.

3.10.7.2 Environmental Consequences

3.10.7.2.1 Proposed Action and Alternatives 2 and 3

Mining the tracts would remove habitat for aquatic species, amphibians and reptiles in a portion of the Belle Fourche River and sections of the ephemeral tributaries to the Belle Fourche. Although the channel and surface water flow would be restored during reclamation, the river would be diverted and habitat for these species would be lost during mining operations. Under natural conditions, habitat for aquatic species is limited on each of the four LBA tracts (as applied for and with added lands), however, as discussed above, a variety of aquatic species and reptiles and amphibians have been observed on and in the vicinity of the tracts.

Under jurisdiction of Cordero Rojo Mine's current WDEQ/LQD mine permit, two sections of the Belle Fourche River have been diverted in order to recover coal from the existing coal leases (section 3.5.2.1). A portion of one of these existing diversion channels that was approved by WDEQ in 1996 (WDEQ/LQD 1996) is just north of the Maysdorf LBA II Tract as applied for.

Reclamation of the various drainage channels and restoration of surface water flow quantity and quality after mining to approximate pre-mining conditions would restore fish habitat and aquatic resources of the Belle Fourche River and other smaller drainages within the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts.

3.10.7.2.2 No Action Alternative

Impacts to reptiles, amphibian, and aquatic species under the No Action alternative would be similar to the impacts described in section 3.10.1.2.2 above.

3.10.8 Threatened, Endangered, Proposed, and Candidate Animal Species, and BLM Sensitive Species

Refer to appendix E the each of the four SGAC Biological Assessments and to appendix F for the SGAC Sensitive Species Evaluation.

3.10.9 Regulatory Compliance, Mitigation and Monitoring

Regulatory guidelines and requirements designed to prevent or reduce surface coal mining impacts to wildlife include:

- fencing designed to permit passage of pronghorn and other big game species to the extent possible;
- development of a Monitoring and Mitigation Plan for raptors and other migratory bird species of management concern that must be approved by the USFWS, including the following provisions:
  - creation of raptor nests and nesting habitat through enhancement efforts (nest platforms, tree plantings) to mitigate other nest sites impacted by mining operations;
  - relocation of raptor nests that would be impacted by mining in accordance with the approved raptor monitoring and mitigation plan;
  - obtaining a permit for removal and mitigation of golden eagle nests and those of other raptor species;
  - restriction of mine-related disturbances from encroaching within stipulated buffers of active raptor nests from egg-laying until fledging to prevent nest abandonment and injury to eggs or young;
  - reestablishment of the ground cover necessary for the return of a suitable raptor prey base after mining;
  - required use of raptor-safe construction for overhead power lines;
- development of a *Migratory Bird Species of Management Concern for Coal Mines in Wyoming Monitoring and Mitigation Plan*, which must be approved by USFWS;

- restoration of sage-grouse habitat after mining including reestablishment of sagebrush and other shrubs on reclaimed lands and grading of reclaimed lands to create swales and depressions suitable for sagebrush obligates and their young;
- restoration of diverse landforms, direct topsoil replacement, and the construction of brush piles, snags, and rock piles to enhance habitat for wildlife;
- restoration of short-grass habitat for species that nest and forage in those habitat types;
- restoration of habitat provided by jurisdictional wetlands; and
- reclamation of the stream channels and restoration of surface water flow quantity and quality after mining to approximate pre-mining conditions.

Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines' current mine permits require reconstruction of bed form features in major stream channels, such as pools and runs, that should help restore the channels' natural function, as well as provide habitat. Restoration will be or may be achieved by salvaging sufficient material from channel terrace alluvium or material having the same physical characteristics to reconstruct pool features. Current reclamation, as well as future reclamation of the Belle Fourche River by the Cordero Rojo Mine would incorporate alluvium salvaged from the original channel. These measures are included in the existing mining and reclamation permit and would be included in the amended mining and reclamation plans, if the LBA tract were leased and proposed for mining.

Baseline wildlife surveys were conducted for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines before mining operations began at the mines. Annual wildlife monitoring surveys have been conducted since the mid-1980s. These surveys are required by state and federal regulations. All four mines also voluntarily conduct annual and/or periodic surveys for additional species that are not included in the monitoring required by state or federal regulations. The wildlife monitoring surveys cover the areas included in the mine permit areas and a perimeter beyond the permit areas that varies in size according to the species being surveyed. As a result, a majority of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts (as applied for, plus added alternative lands and a surrounding one-quarter-mile perimeter) have been surveyed as part of the required monitoring surveys for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines, respectively.

The annual monitoring programs include:

- spring surveys for new and/or occupied raptor nests, upland game bird lek locations, T&E species, and migratory birds;
- late spring surveys of raptor production for occupied nests, opportunistic observations of all wildlife species, T&E species, and migratory birds;
- raptor territorial occupancy and nest productivity is surveyed annually on and within a 1- or 2-mile perimeter surrounding the existing permit areas, depending on the mine;
- summer surveys for raptors, migratory birds, and lagomorph density;
- winter surveys for bald eagle winter roosts on and within 1 mile of the permit area (conducted as needed based on proximity of disturbance to potential roosting habitat);
- voluntary winter surveys for big game on and surrounding the permit area (currently conducted during alternate years) (Belle Ayr, Coal Creek, and Caballo mines only);
- voluntary aquatic surveys for fish and macro-invertebrates within the existing permit area (previous annual schedule, currently conducted during alternate years) (Belle Ayr Mine only);
- voluntary annual surveys for migrating and nesting waterfowl, shorebirds, and other water obligate avian species (historically Belle Ayr and Coal Creek mines, currently only Belle Ayr Mine); and
- breeding bird surveys (previously voluntary and periodic at Belle Ayr Mine, now required annually at all mines).

Monitoring data were collected by all of the surface coal mines in the PRB for big game species from at least 1995 until 1999, with most mines conducting annual surveys since the mid- to late 1980s. At that time, the WGFD reviewed monitoring data and requirements for big game species on those mine sites. They concluded that the monitoring had demonstrated a lack of impacts to big game on existing mine sites. No severe mine-caused mortalities had occurred and no long-lasting impacts on big game had been noted on existing mine sites. The WGFD therefore recommended at that time that big game monitoring be discontinued on all existing mine sites. New mines will be required to conduct big game monitoring if located in crucial winter range or in significant migration corridors, neither of which are present within the wildlife general analysis area. Although big game surveys are no longer required as part of the annual wildlife monitoring program at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines, FCW, TBCC, and PRCC have voluntarily continued these surveys on a reduced but regular schedule.

There are approved raptor monitoring and mitigation plans for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines. These monitoring and mitigation plans would be amended to include the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts (as applied for and added lands) if they are leased and proposed for mining. The amended raptor mitigation plans would be subject to review and approval by USFWS before the amended mining plans are approved.

Monitoring and mitigation plans for Migratory Bird Species of Management Concern have also been developed in cooperation with USFWS for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mining operations, and those plans would be amended to include the LBA tracts and any added lands. If additional species are documented nesting or using the area regularly, a mitigation plan would be developed to protect those birds and their habitat.

3.10.10 Residual Impacts

Although the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts would be reclaimed in accordance with the requirements of SMCRA and Wyoming statutes, there would be some residual wildlife impacts. The topographic moderation would result in a permanent loss of habitat diversity and a potential decrease in slope-dependent shrub communities. This would reduce the carrying capacity of the land for shrub-dependent species. Reclamation standards for bond release may also limit replacement of habitat for some species that occupy somewhat specialized, low-growth form habitats. Those species may repopulate reclaimed areas, but populations may not attain pre-mining levels without special variances to accommodate those specific needs. For example, every effort would be made to preserve source populations of prairie dogs in the vicinity of development, as these animals can be valuable in restoring similar structural characteristics of pre-mine grassland species through regular clipping and harvesting of vegetation.

Limited riparian habitat is present in the general South Gillette analysis area. Areas that currently support sagebrush would be altered to a grassland community, perhaps for decades, during the interim between sage plantings and maturity in reclamation. Until pre-mining habitats have been fully reestablished, such habitat transformations would likely result in a change in wildlife species composition. Minimal residual impacts to T&E, candidate, or proposed plant and animal species are expected to occur, because state and federal regulations require reclamation of specific habitats.

3.11 Land Use and Recreation

3.11.1 Affected Environment

Surface ownership within the general South Gillette analysis area consists primarily of private lands with some intermingled federal lands. The federally

owned lands included in the tract are administered by the BLM. Surface ownership for each LBA tract study area is shown in table 3-13 and in figures 3-32 through 3-35.

Table 3-13. Distribution of Surface Ownership Within Each LBA Tract Study Area.

LBA Tract Configuration	Federal Ownership (Acres)	(Percent)[1]	Private Ownership (Acres)	(Percent)[1]
Belle Ayr North	0.00	0.0	1,752.03	100.0
West Coal Creek	0.00	0.0	1,232.17	100.0
Caballo West	0.00	0.0	1,024.00	100.0
Maysdorf II	284.96	5.8	4,610.67	94.2
Total	**284.96**	**3.2**	**8,618.87**	**96.8**

[1] Based on total acres (Proposed Action plus action alternatives).

Livestock grazing on native rangeland is the primary land use, while oil and gas production, wildlife habitat, communication and power lines, transportation, and recreation are secondary land uses for both public and private lands.

Areas of disturbance within and near the proposed lease are generally associated with roads, oil and gas wells and production facilities, surface mine-related facilities, and ranching operations. State Highway 59 is adjacent to one LBA tract and up to several miles west of the other LBA tracts. Several county and unnamed two-track roads traverse and provide public and private access within and near the proposed lease areas. The county roads include the Haight Road, T-7 Road, Hoadley Road, Bishop Road, and the Hilight Road. The BNSF & UP railroad right-of-way also crosses a small portion of the Maysdorf II Tact.

The oil and gas estate within the general South Gillette analysis area is federally and privately owned, with the majority (approximately 90 percent) being privately owned. Most of the federally owned oil and gas estate is leased. The ownership of the oil and gas estate for the LBA tracts is shown on figures 3-36 through 3-39. Lists of the current federal oil and gas lessees within the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts are listed in tables 3-14 through 3-17, respectively.

According to the WOGCC records as of December 13, 2007, there were 60 permitted conventional oil and gas wells within the LBA tracts as proposed and the lands added under action alternatives (figures 3-36 through 3-39). Of these 60 wells, 34 were permanently abandoned, 16 wells were still producing, seven well were active injectors, one well was shut in, one was a permanently abandoned injector hole, and one was temporarily abandoned. Of the 18 wells capable of producing, 13 have economically recoverable reserves. Eight of the 13 wells with recoverable reserves are on private leases. While the seven injector wells are not

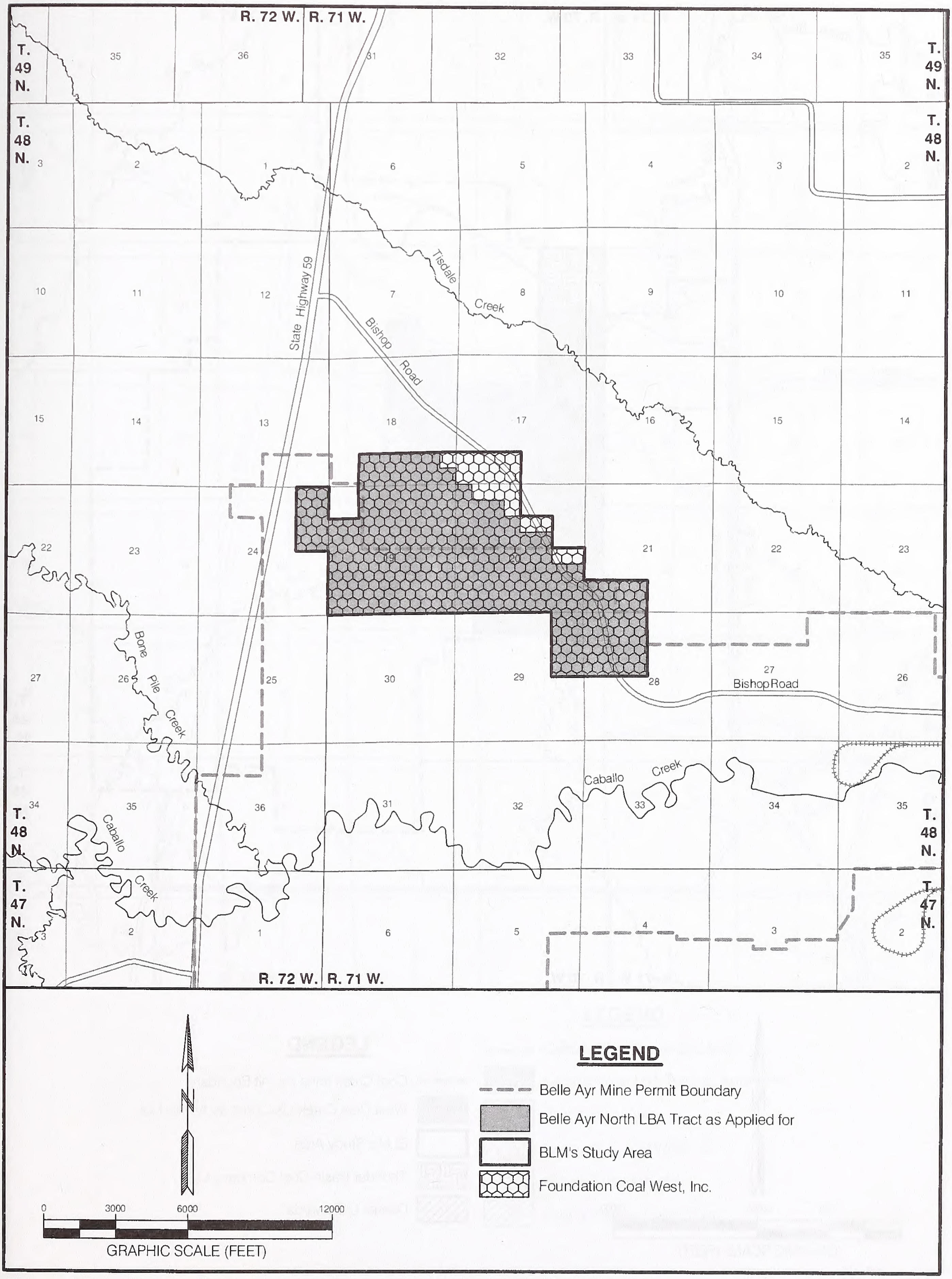


Figure 3-32. Surface Ownership Within the Belle Ayr North LBA Tract Alternatives.

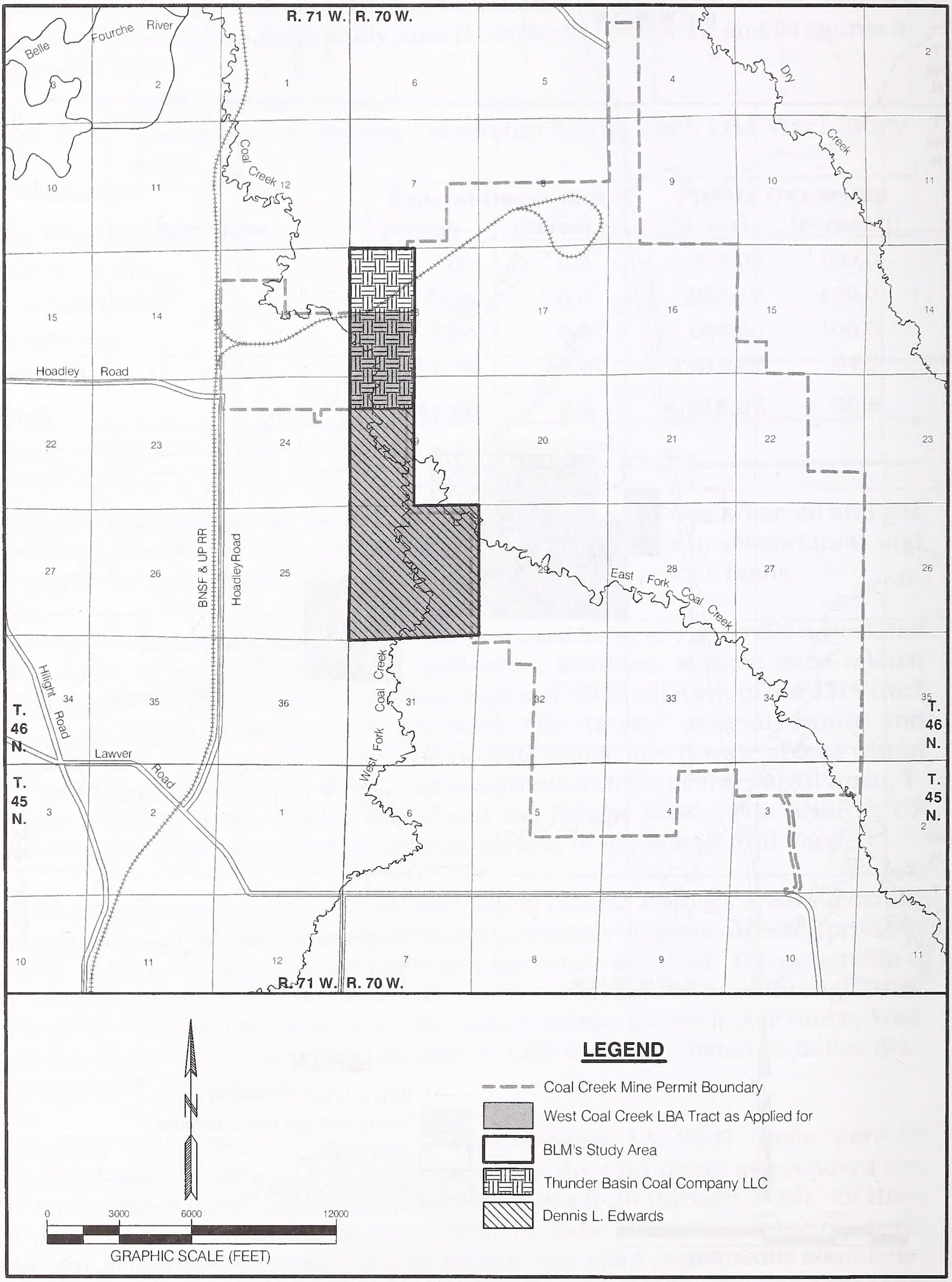


Figure 3-33. Surface Ownership Within the West Coal Creek LBA Tract Alternatives.

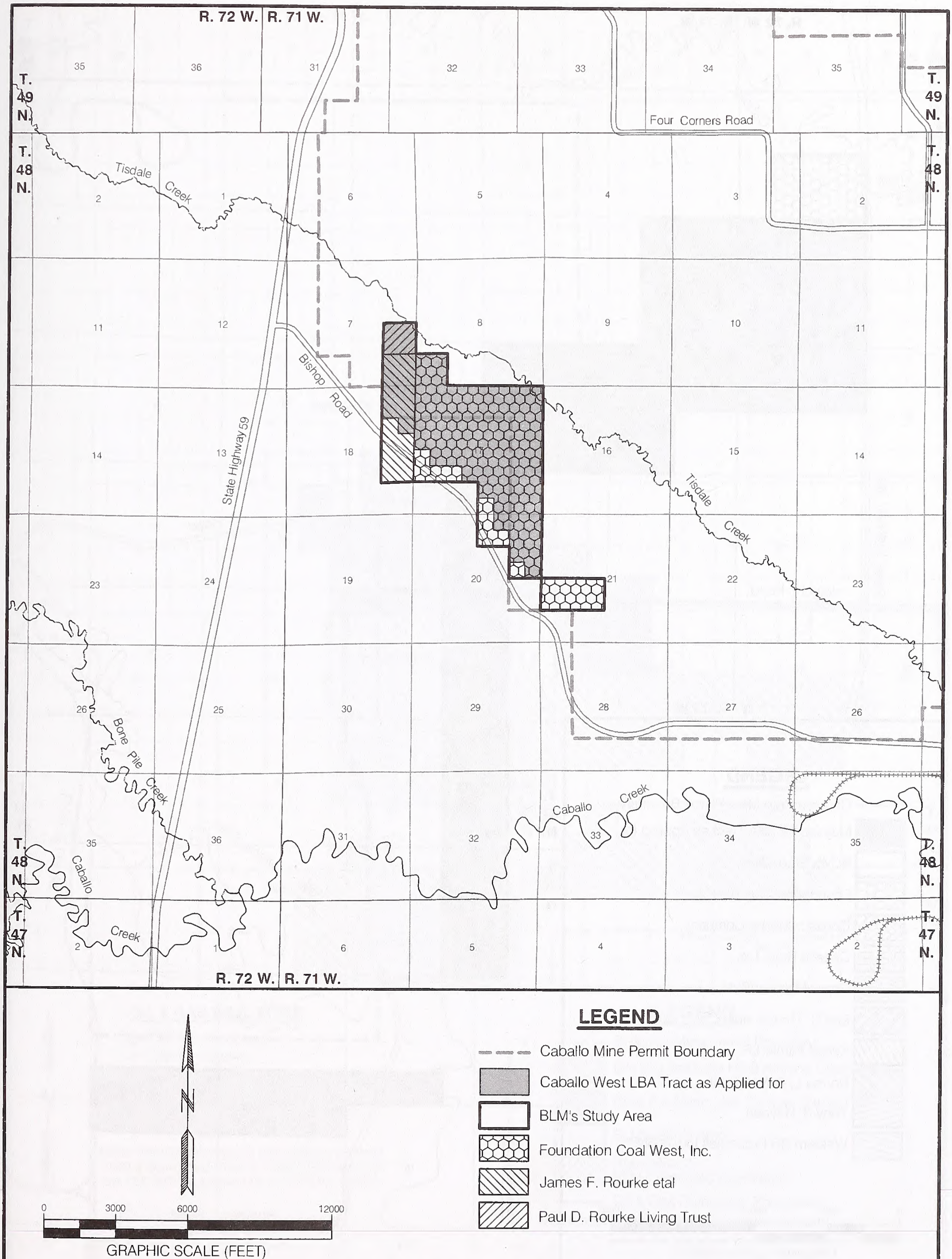


Figure 3-34. Surface Ownership Within the Caballo West LBA Tract Alternatives.

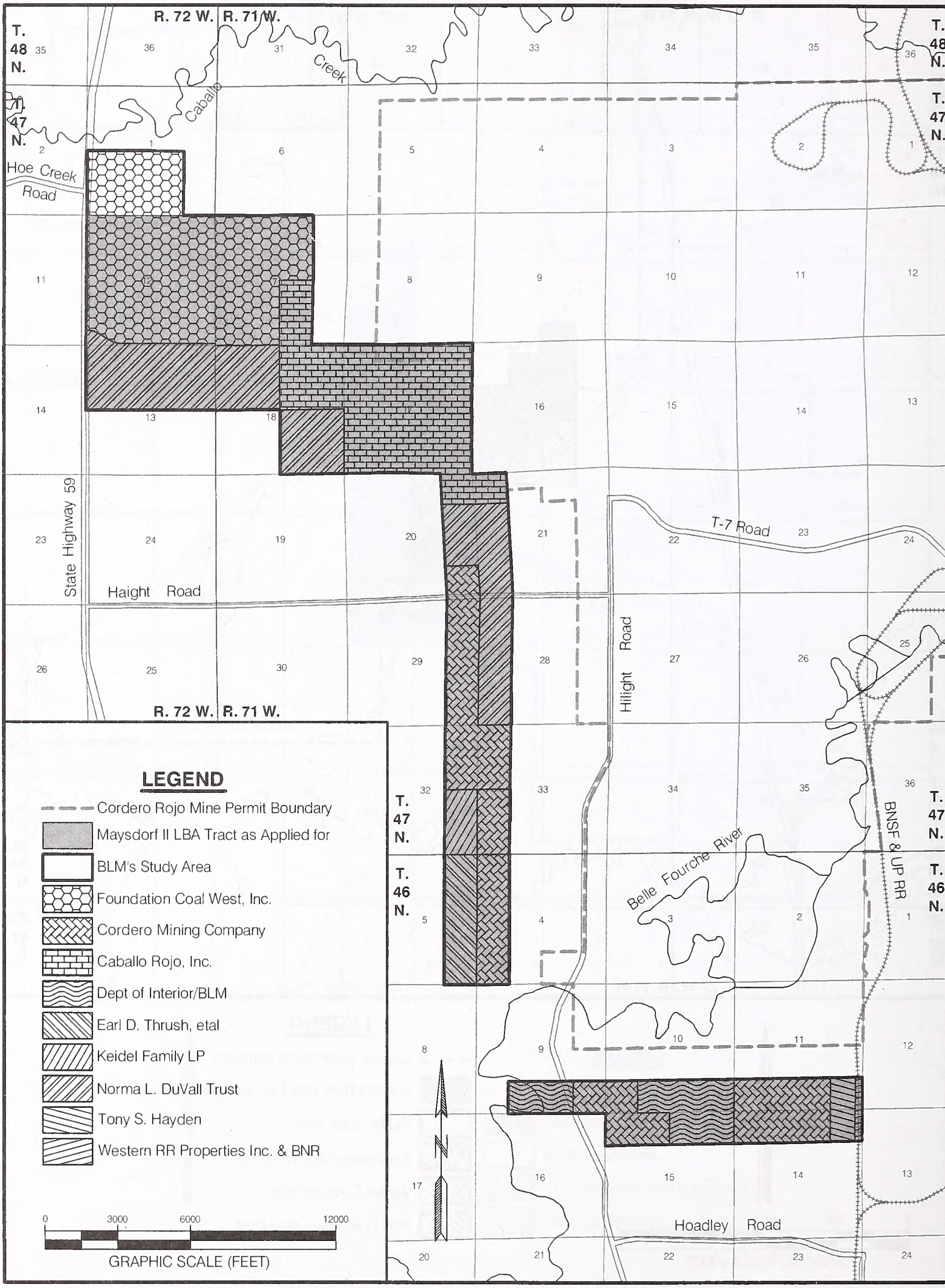


Figure 3-35. Surface Ownership Within the Maysdorf II LBA Tract Alternatives.

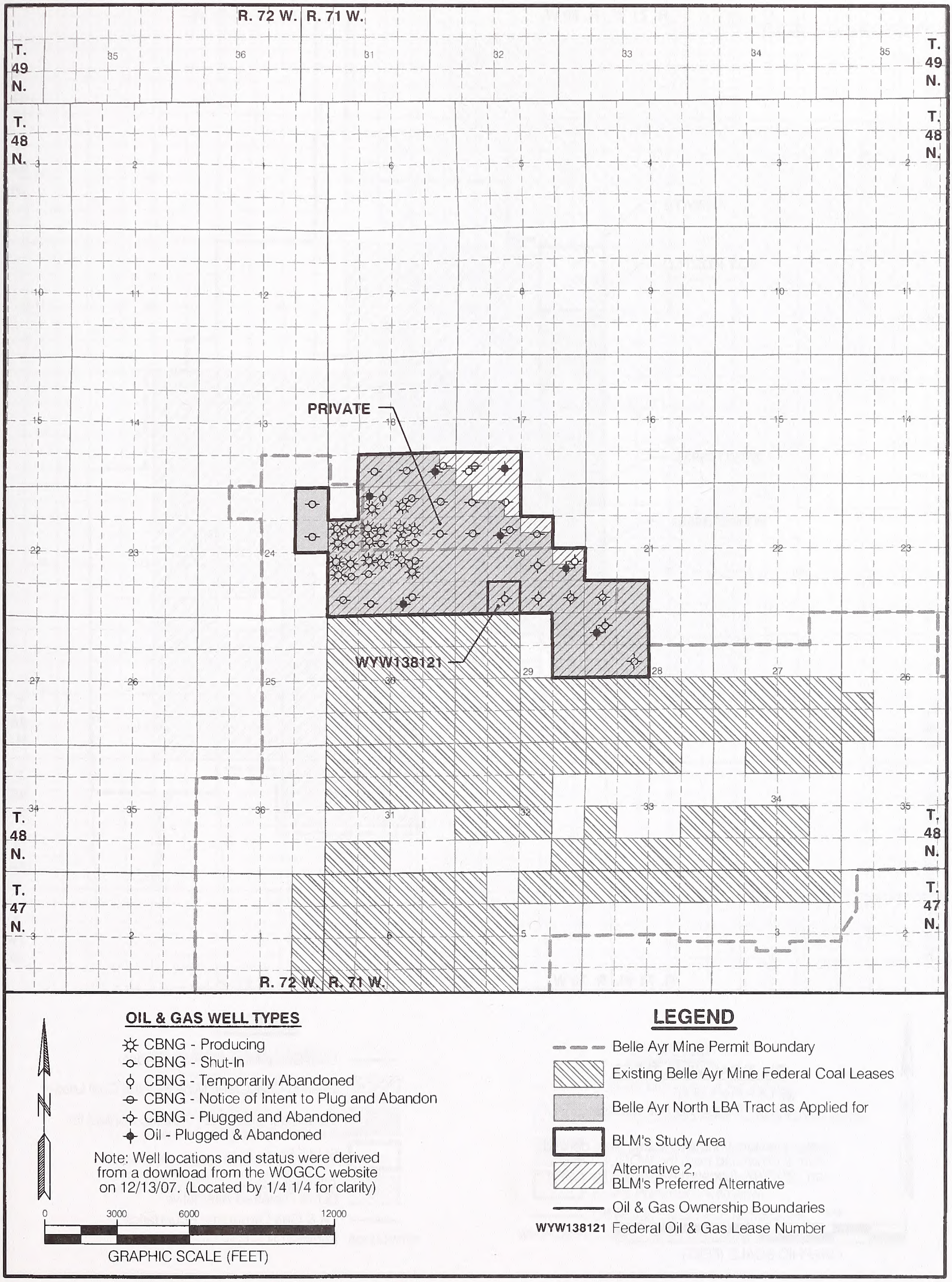


Figure 3-36. Oil and Gas Wells and Oil and Gas Ownership Within the Belle Ayr North LBA Tract Alternatives.

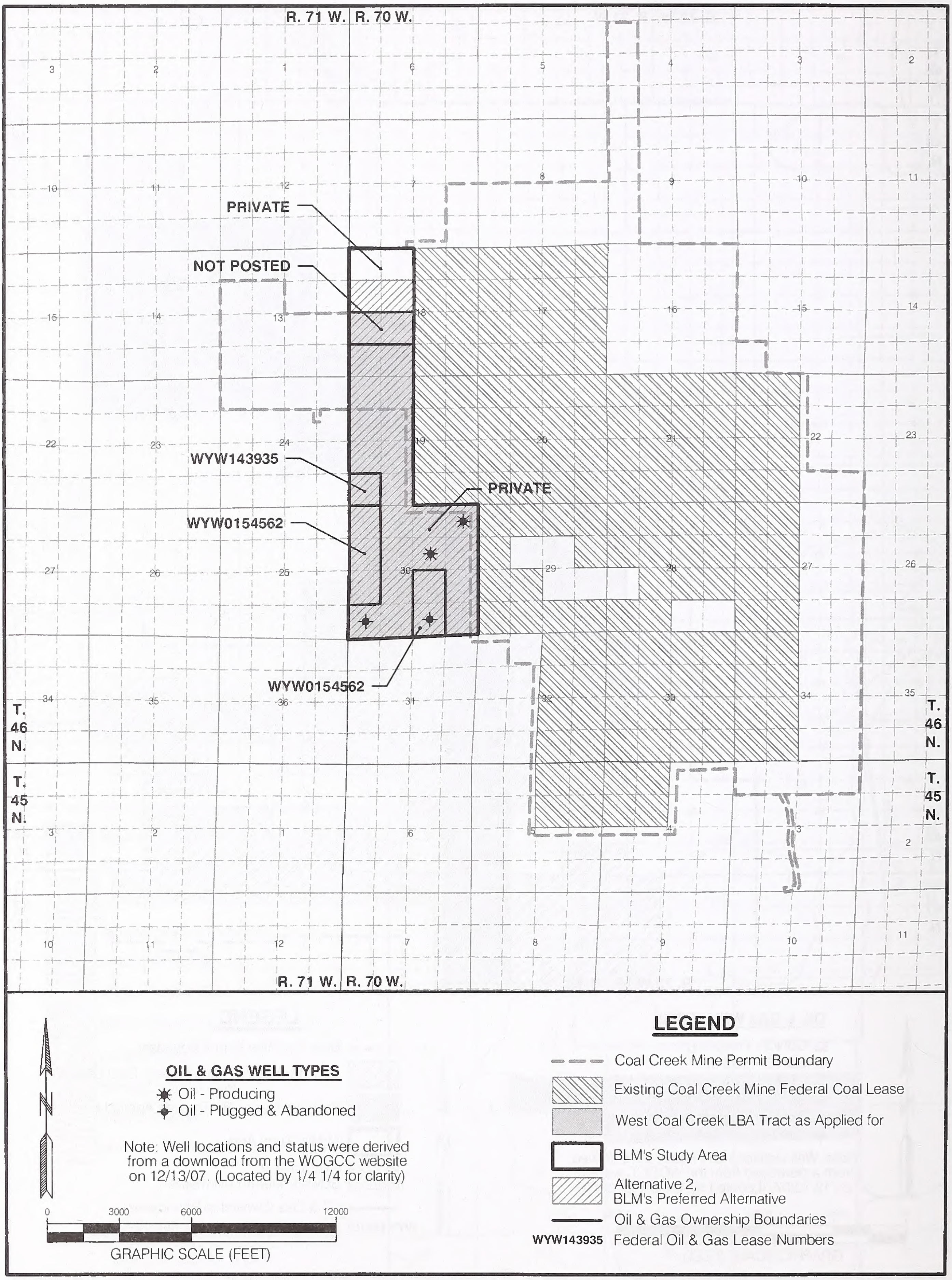


Figure 3-37. Oil and Gas Wells and Oil and Gas Ownership Within the West Coal Creek LBA Tract Alternatives.

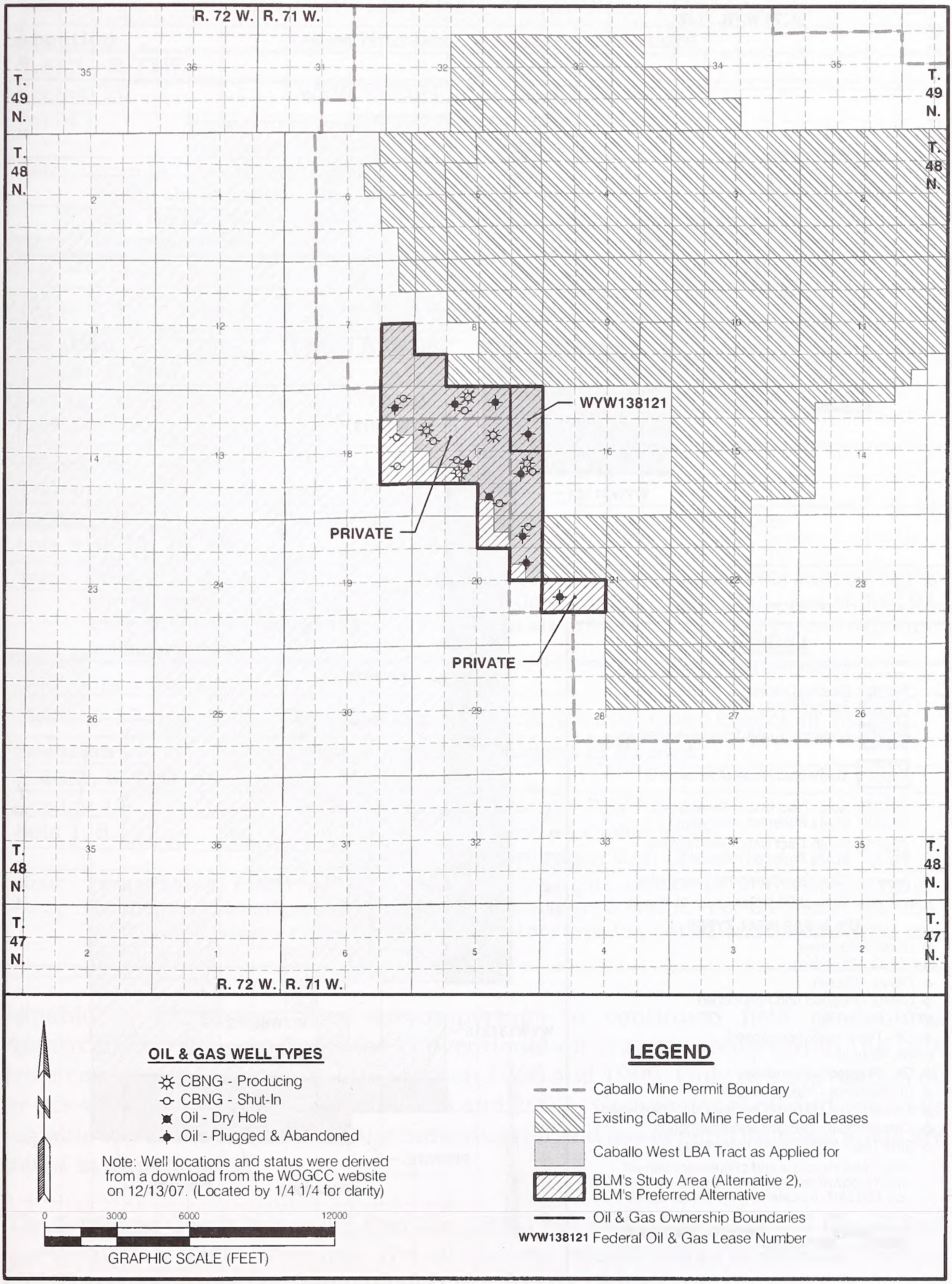


Figure 3-38. Oil and Gas Wells and Oil and Gas Ownership Within the Caballo West LBA Tract Alternatives

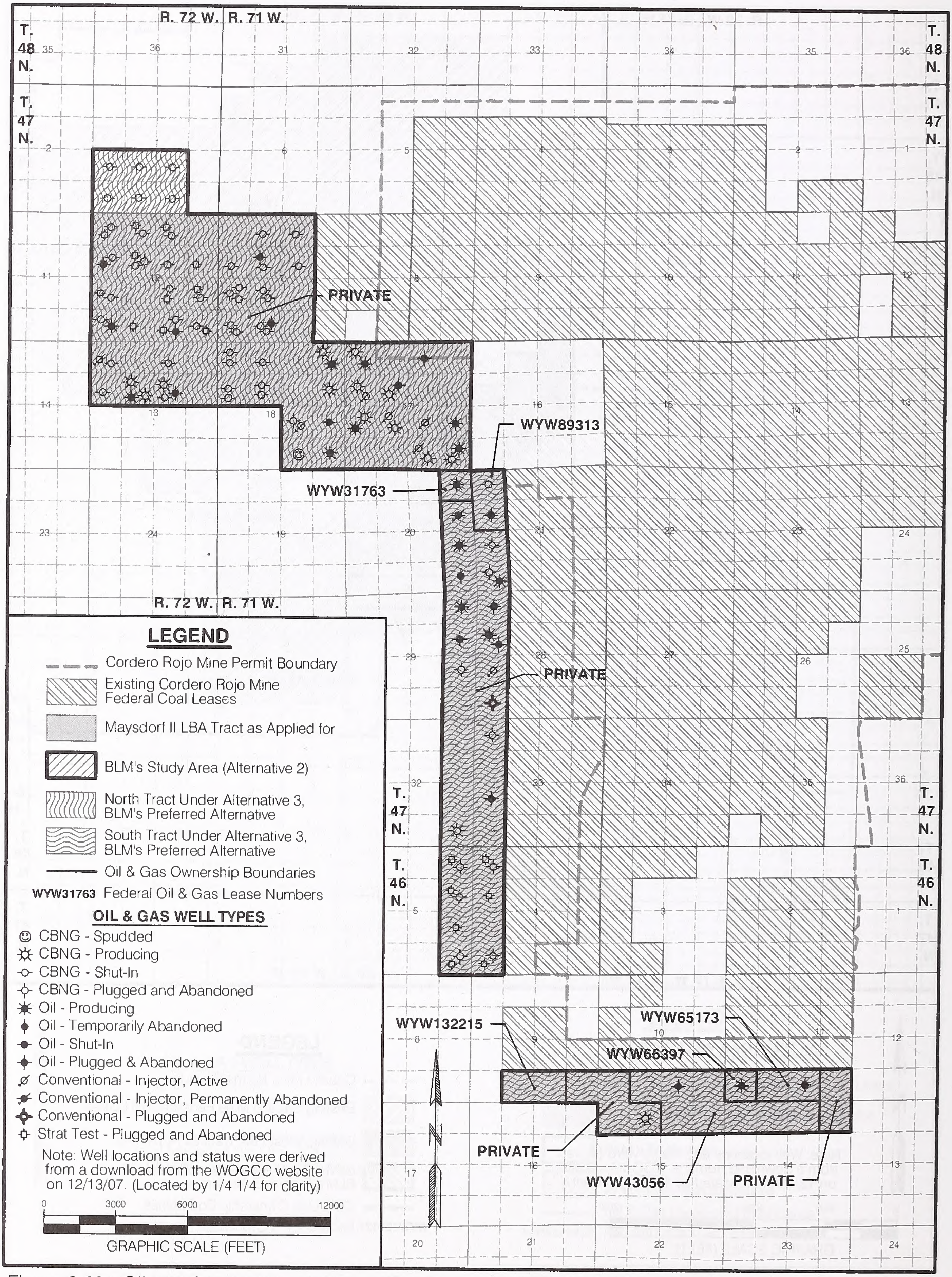


Figure 3-39. Oil and Gas Wells and Oil and Gas Ownership Within the Maysdorf II LBA Tract Alternatives.

Table 3-14. Belle Ayr North LBA tract Federal Oil and Gas Lessees of Record.

Location	Lease Number	Lessees of Record
T.48N., R.71W.		
Section 20 Lot14	WYW 138121	Cavalier Petro Corp. Michael Diefenderfer Pendragon Res. LP

Note: From BLM OG Plat (11/20/07). The oil and gas rights (including CBNG) and coal rights for the above locations are owned by the federal government. For the rest of the LBA tract, the oil and gas rights (including CBNG) are privately owned, and the coal rights are federally owned.

Table 3-15. West Coal Creek LBA tract Federal Oil and Gas Lessees of Record.

Location	Lease Number	Lessees of Record
T.46N., R.70W.		
Section 18 Lots 14, 15	Not Posted	
Section 19 Lot 17	WYW 143935	Maurice W. Brown
Section 30 Lots 8, 9, 14, 16, 19	WYW 0154562	Primary Natural Resources

Note: From BLM OG Plat (10/29/07). The oil and gas rights (including CBNG) and coal rights for the above locations are owned by the federal government. For the rest of the LBA tract, the oil and gas rights (including CBNG) are privately owned, and the coal rights are federally owned.

Table 3-16. Caballo West LBA tract Federal Oil and Gas Lessees of Record.

Location	Lease Number	Lessees of Record
T.48N., R.71W.		
Section 17 Lots 1, 8	WYW 138121	Cavalier Petro Corp. Michael Diefenderfer Pendragon Res. LP

Note: From BLM OG Plat (11/20/07). The oil and gas rights (including CBNG) and coal rights for the above locations are owned by the federal government. For the rest of the LBA tract, the oil and gas rights (including CBNG) are privately owned, and the coal rights are federally owned.

capable of producing, they are important to continued field production. Approximately 97 percent of the conventional oil and gas wells within the LBA tract configurations were drilled between 1966 and 1999. Only two convention oil or gas wells were drilled between 2000 and 2007. Conventional oil and gas wells capable of production on or in the individual oil and gas general analysis areas are listed in appendix G.

The Supreme Court has ruled that the CBNG belongs to the owner of the oil and gas estate (98-830). Therefore, the oil and gas lessees have the right to develop CBNG as well as conventional oil and gas on the LBA tracts.

Table 3-17. Maysdorf II LBA tract Federal Oil and Gas Lessees of Record.

Location	Lease Number	Lessees of Record
T.47N., R.71W.		
Section 7 Lot 8	WYW 144480	ABO Petro Corp. MYCO Industries Inc. Yates Drilling Co. Yates Petroleum Corp
Section 20 Lot 1	WYW 31763	Bowden Energy Co. Inc.
Section 21 Lots 4, 5	WYW 89313	Club O&G LTD Dunway Investment Co. Electra Investment JWD III Inc. Raymond T Duncan Oil Prop. LTD Walter Duncan Oil
T.46N., R.71W.		
Section 9 Lots 6, 7	WYW 132215	Maurice W. Brown
Section 10 Lots 8, 9, 10	WYW 43056	AG Andrikopoulos Res. Chaco Energy Co. Key Production Co. Nance Petroleum Corp.
Section 11 Lot 13	WYW 66397	Key Production Co. Nance Petroleum Corp. P&M Petro Mgmt. CCC
Section 11 Lots 14, 15	WYW 65173	Mary Hudson Ard Bill Barrett Corporation Delnar Hudson Lewis Living Trust Edward R Hudson Jr. William A Hudson III Lindy's Living Trust
Section 14 Lots 2, 3, 4	WYW 43056	AG Andrikopoulos Res. Chaco Energy Co. Key Production Co. Nance Petroleum Corp.
Section 15 Lots 1, 2	WYW 43056	AG Andrikopoulos Res. Chaco Energy Co. Key Production Co. Nance Petroleum Corp.

Note: From BLM OG Plats (1/12/07 & 10/4/07). The oil and gas rights (including CBNG) and coal rights for the above locations are owned by the federal government. For the rest of the LBA tract, the oil and gas rights (including CBNG) are privately owned, and the coal rights are federally owned.

According to the WOGCC records as of December 13, 2007, there were 153 permitted CBNG wells on lands included in the LBA tracts as proposed and the lands added under action alternatives (figures 3-36 through 3-39). Of these, 37 CBNG wells that were producing, 75 were shut-in, 20 permanently abandoned, one was temporarily abandoned, one was spudded, one had a notice of intent to abandon, and 18 were permanently abandoned strat test holes. Extensive CBNG

development has occurred west of the tracts. CBNG wells capable of production on or in sections adjacent to the LBA tracts are listed in appendix G.

Additional information on the conventional oil and gas and CBNG development in the general South Gillette analysis area and surrounding area is included in section 3.3.2. Certain ancillary facilities are needed to support oil and gas production. These support facilities may include well access roads, well pads, production equipment at the wellhead (which may be located on the surface and/or underground), well production casing (which extends from the surface to the zone of production), underground pipelines (which gather the oil, gas, and/or water produced by the individual wells and carry it to a larger transmission pipeline or collection facility), facilities for treating, discharging, disposing of, containing, or injecting produced water, central metering facilities, electrical power utilities, gas compressor stations, and high-pressure transmission pipelines for delivering the gas to market. Currently, there are some oil and gas production facilities, primarily oil and gas pipelines, on the LBA tracts, as discussed in section 3.15 of this EIS. It is unlikely that additional support facilities will be constructed on the LBA tracts because approximately 70 percent of the conventional oil and gas and CBNG wells that exist on the tracts have been either shut in or plugged and abandoned due to exhausted reserves and diminished production.

Coal mining is a dominant land use in the general South Gillette analysis area. The Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines form a group of contiguous or nearly contiguous surface coal mines located in Campbell County (Figure 1-1). Coal production from these mines increased by 65 percent between 1994 and 2007 (from approximately 66 million tons in 1994 to 109 million tons in 2007). Two leases, the West Rocky Butte lease and the South Maysdorf lease, have been issued within this group of four mines since decertification of the federal coal region. The currently pending Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II lease applications evaluated in this EIS are in this group of mines (tables 1-1 and 1-2).

Campbell County does not have a county-wide land use plan, but has been working on a comprehensive land use plan jointly with the City of Gillette (City of Gillette 1978 and Campbell County 2005). The Gillette area land use plan is an integral part of the overall plan for Campbell County and recommends general types of uses for the area immediately surrounding the City of Gillette (City of Gillette 1978). The proposed lease area does not have a designated zoning classification. The *City of Gillette/Campbell County Comprehensive Planning Program* (City of Gillette 1978) provides general land use goals and policies for state and federal coal leases in the county.

Big game hunting is the principal recreational land use within the general South Gillette analysis area, and pronghorn, mule deer, and white-tailed deer are present within the area (section 3.10.2). On private lands, hunting is allowed only

with landowner permission. Land ownership within the PRB is largely private (approximately 80 percent), with some private landowners permitting sportsmen to cross and/or hunt on their land. There has been a trend over the past 2 to 3 decades towards a substantial reduction in private lands that are open and reasonably available for hunting. Access fees continue to rise and many resident hunters feel these access fees are unreasonable. This trend has created problems for the WGFD in their attempt to distribute and control harvest at optimal levels, as well as for sportsmen who desire access to these animals (WGFD 2004).

In general, publicly owned lands (i.e., Forest Service or BLM-administered federal lands and state school sections) are open to hunting if legal access is available. Due to safety concerns, however, public surface lands contained within an active mining area are generally closed to the public, further limiting recreational use. There are approximately 285 acres of public surface lands within the Maysdorf II LBA tract (figure 3-35). There are no public surface lands within the Belle Ayr North, West Coal Creek, and Caballo West LBA tracts (figures 3-32 through 3-34). A maximum of approximately 82 acres of the public surface are currently accessible to the public under any of the alternatives.

Specific details regarding big game herd management objectives within and near the general South Gillette analysis area are contained in the *Casper* and *Sheridan Region Annual Big Game Herd Unit Job Completion Reports* (WGFD 2008). The WGFD classifies the entire general South Gillette analysis area as yearlong and winter/yearlong habitat for antelope. No crucial or critical pronghorn habitat is recognized by the WGFD in this area (Note: WGFD definitions of big game ranges are included in section 3.10.2.1). The proposed lease area is within pronghorn antelope Hunt Area 24, which is contained in the Hilight Herd Unit. In post-season 2007, the WGFD estimated the Hilight Herd Unit to be 12,397 animals, with an objective of 11,000 (WGFD 2008).

Historical problems associated with the management of the Hilight Herd Unit include hunter access, over harvest on limited public lands, and quantifying landowner preferences and desires. Prior to 1997, the herd population was fairly stable and near the objective of 11,000 antelope. Losses from severe winters, poor production rates, and disease subsequently decreased the population, but it has recently recovered and is currently above the objective level. Hunt Area 24 contains mostly privately owned surface lands with poor hunter access to limited publicly owned lands; therefore, the number of antelope is expected to steadily increase. If the population exceeds objective levels, more licenses will be needed and these may be difficult to sell in this mostly private land area. Nearly all landowners charge access fees for hunting and private land access is based on the desires and perceptions of the landowners. Increased harvest may be difficult to achieve because of the increased CBNG development, which is limiting rifle hunting on associated lands. Given the predicted harvest and average winter conditions, the 2008 post-season population was expected to be 12,129 antelope.

The WGFD has classified the majority of the general South Gillette analysis area as yearlong mule deer use range. Crucial or critical mule deer habitat does not occur on or within several miles of the general South Gillette analysis area. The proposed lease area is located within mule deer Hunt Area 21, part of the Thunder Basin Mule Deer Herd Unit, which also includes Hunt Areas 7, 8, 9, 10, and 11. The Thunder Basin Herd Unit encompasses 3,642 square miles, of this, 71 percent is privately owned. Access fees are common, resulting in heavy hunting pressure on accessible public lands, particularly in recent years. Between 1983 and 2001, the post-season objective for this mule deer herd was 13,000, but the population was consistently above that objective. The 2003 post-season population was estimated at 19,299, which was 67 percent above the objective. WGFD increased the objective to 20,000 head in December 2001. Due to changes in the modeling program used to estimate mule deer populations, WGFD revised the herd unit population estimates following 2003, reducing the herd estimate. The revised 2003 population estimate was 17,616. The WGFD estimated the 2007 post-season mule deer population for the herd unit at 20,980, which is slightly above the current objective of 20,000 (WGFD 2008). It is likely that insufficient harvest from private land within Hunt Area 21 will result in a population increase in the future.

A majority of the South Gillette Analysis Area is within HA 129 (a non-herd unit). The southern portion of the general South Gillette analysis area is within Elk Hunt Area 123 of the Rochelle Hills Herd Unit. The Rochelle Hills Elk Herd resides in the Rochelle Hills located east and south of the general South Gillette analysis area. The herd favors the ponderosa pine/juniper woodlands, savanna, and steeper terrain habitat offered by the Rochelle Hills. As more lands are reclaimed from mining, elk are shifting their winter use to these areas. The WGFD has designated an approximately five square mile area on reclaimed lands within the Jacobs Ranch Mine permit area as crucial winter habitat for the Rochelle Hills elk herd (Oedekoven 1994). RTEA (owner of the Jacobs Ranch Mine) and the RMEF finalized a formal agreement that created the Rochelle Hills Conservation Easement. The easement contains nearly 1,000 acres, with 75 percent of that total comprised of reclaimed mining lands on RTEA's Jacobs Ranch Mine. The easement acreage was donated to RMEF by RTEA to ensure that the reclaimed land continues to be used as grazing land and wildlife habitat for the extended future (RMEF 2007). The Jacobs Ranch Mine is located about 9 miles south of the general South Gillette analysis area. No elk have been observed recently within any of the tracts but they are occasionally recorded in the Pine Hills to the east. This dispersion is likely due to increasing population density and habitat limitations within the normal herd boundary. Elk may potentially expand into the general South Gillette analysis area in the future.

White-tailed deer are not managed separately by WGFD, but are included with mule deer as part of the Thunder Basin Herd Unit. White-tailed deer are seldom observed within the general South Gillette analysis area due to their preference for riparian woodlands and irrigated agricultural lands. WGFD classifies the entire

general South Gillette analysis area, with the exception of a narrow corridor along the Belle Fourche River, as out of normal white-tailed deer use range. The narrow corridor along the Belle Fourche is classified as yearlong range.

Under natural conditions, aquatic habitat is very limited by the ephemeral nature of surface waters in the general South Gillette analysis area; therefore, public fishing opportunities are very limited. The lack of deep-water habitat and extensive and persistent water sources limits the presence and diversity of fish and other aquatic species. However, water discharged from CBNG wells upstream of the general South Gillette analysis area has supplied the Belle Fourche River with water nearly continuously, resulting in an increase in habitat for aquatic species. The Belle Fourche River currently supports a variety of nongame fish in the general South Gillette analysis area (section 3.10.6).

Sage-grouse, mourning dove, waterfowl, rabbit, and coyote are hunted in the general vicinity, and some coyote and red fox trapping may occur.

As described above, approximately 97 percent of the surface estate of the SGAC LBA tracts is owned by private individuals/companies and most of the subsurface minerals (all of the coal and approximately 90 percent of the oil and gas estate) are federally owned, which results in split estate situations. In these situations, mineral rights are considered the dominant estate, meaning they take precedence over other rights associated with the property, including those associated with owning the surface. However, the mineral owner must show due regard for the interests of the surface estate owner and occupy only those portions of the surface that are reasonably necessary to develop the mineral estate (BLM 2009b).

BLM has developed a policy to address the split estate issue. The BLM's split estate policy only applies to situations where the surface rights are in private ownership and the rights to development of the mineral resources are publicly held and managed by the Federal government (BLM 2009b).

BLM manages the public lands, including the Federal mineral estate, to enhance the quality of life for present and future generations of Americans, under a mandate of multiple use as described in the Federal Land Policy and Management Act. The Mineral Leasing Act guides the land use planning, leasing, bonding, operations and reclamation associated with all development of Federal oil and natural gas resources (BLM 2009b).

Various laws granted land patents to private individuals but reserved the mineral rights to the Federal Government. BLM must comply with the provisions of the laws under which the surface was patented. However, many of those laws do not identify the rights of the surface owner in split estate mineral development situations (BLM 2009b).

3.11.2 Environmental Consequences

3.11.2.1 Proposed Action and Alternatives 2 and 3

The major adverse environmental consequences of leasing and mining the LBA tracts on land use would be the reduction of livestock grazing (cattle and sheep), loss of wildlife habitat (particularly big game), and curtailment of oil and gas development while the coal is being mined and during reclamation. This would include removal of all existing oil and gas surface and downhole production and transportation equipment and facilities. Wildlife and livestock use would be displaced while the tract is being mined and reclaimed. Grazing leases would be suspended on approximately 285 acres of federal lands if the LBA tracts were leased under the Proposed Actions and other action alternatives. This federal land is within Grazing Allotment #22027, currently held by Dave Edwards (valid through July 2014) and Grazing Allotment #02349, currently held by Donald Wagensen, Opal Marquis, and Doris Marquis (valid through January 2014). Access for recreational and other activities (i.e., ranching, oil and gas development) would be restricted during mining operations. Estimated disturbance areas for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts and the tract configurations for the action alternatives are presented in tables 3-1 through 3-4, respectively.

Sections 3.3.2 and 3.11.1 and appendix G of this document address producing, abandoned, and shut in oil and gas (conventional and CBNG) wells in the BLM study areas. Well location information, federal oil and gas ownership, and federal oil and gas lessee information for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts are presented in figures 3-36 through 3-39, respectively and tables 3-14 through 3-17, respectively. BLM manages federal lands on a multiple use basis, in accordance with the regulations. In response to conflicts between oil and gas and coal lease holders, BLM policy advocates optimizing the recovery of both coal and CBNG resources to ensure that the public receives a reasonable return for these publicly owned resources. Optimal recovery of both coal and oil and gas resources requires negotiation and cooperation between the oil and gas lessees and the coal lessees. In the past, negotiations between some of the applicant mines and some of the existing oil and gas lessees have resulted in agreements that allow development of both resources in this area. Producing conventional oil and gas and CBNG wells are present on the LBA tracts. In the PRB, royalties have been and would be lost to both the state and federal governments if conventional oil and gas wells are abandoned prematurely, if the federal CBNG is not recovered prior to mining, or if federal coal is not recovered due to conflicts. State and federal governments can also lose bonus money when the costs of the agreements between the lessees are factored into the fair market value determinations.

Up to 285 acres of BLM-administered federal surface would be affected during mining operations if the Belle Ayr North, West Coal Creek, Caballo West, and

Maysdorf II LBA tracts are leased under the Proposed Action or action alternatives, but only about 82 of those acres are currently accessible by the public. The loss of access to federal lands is long term (during mining and reclamation), but is not permanent. Public access to federal lands would be restored after mining and reclamation are complete.

Hunting on the LBA tracts, including the federal surface discussed above would be eliminated during mining and reclamation. Pronghorn and mule deer have been observed on and adjacent to the LBA tracts, as have sage-grouse, mourning doves, waterfowl, rabbits, and coyote. The federal lands actually represent a relatively small portion of the currently accessible public surface lands for recreational opportunity within the respective animal hunt areas.

Following reclamation, the land would be suitable for grazing and wildlife uses, which are the historic land uses. The reclamation standards required by SMCRA and Wyoming State Law meet the standards and guidelines for healthy rangelands for public lands administered by the BLM in Wyoming. Following reclamation bond release, management of the privately owned surface would revert to the private surface owner and management of the federally owned surface would revert to the federal surface managing agency (BLM).

Some conflicts may arise due to split estate issues regarding ownership of the surface on the SGAC LBA tracts and ownership of the subsurface minerals. Conflicts may also arise between oil and gas and coal lease holders. BLM must comply with the provisions of the laws under which the surface was patented. BLM policy also advocates optimizing the recovery of both coal and CBNG resources to ensure that the public receives a reasonable return for these publicly owned resources.

3.11.2.2 No Action Alternative

Under the No Action alternatives, the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications would be rejected and coal removal and associated disturbance and impacts would not occur on the additional acres that would be disturbed under the Proposed Action or other action alternatives for each tract. Currently approved mining operations would continue on the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine leases. Impacts to land use related to mining operations at these mines would not be extended onto portions of the LBA tracts that will not be affected under the current mining and reclamation plan.

As discussed in chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA lease applications at this time would not preclude an application to lease the tracts in the future.

3.11.3 Regulatory Compliance, Mitigation and Monitoring

Mined areas would be reclaimed as specified in the approved mine plan to support the anticipated post-mining land uses of wildlife habitat and rangeland. The reclamation procedures would include stockpiling and replacing topsoil, using reclamation seed mixtures, which would be approved by WDEQ, and replacing stock reservoirs.

Steps to control invasion by weedy (invasive nonnative) plant species using chemical and mechanical methods would be included in the amended mine plan. Revegetation growth and diversity would be monitored until the final reclamation bond is released (a minimum of 10 years following seeding with the final seed mixture). Erosion would be monitored to determine if there is a need for corrective action during establishment of vegetation. Controlled grazing would be used during revegetation to determine the suitability of the reclaimed land for anticipated post-mining land uses.

See section 3.3.2.3 for discussion of regulatory requirements, mitigation and monitoring related to oil and gas development.

3.11.4 Residual Impacts

No residual impacts to land use and recreation are expected.

3.12 Cultural Resources

3.12.1 Affected Environment

Cultural resources, which are protected under the National Historic Preservation Act of 1966, are nonrenewable remains of past human activity. The PRB, including the general South Gillette analysis area, appears to have been inhabited by aboriginal hunting and gathering people for more than 13,000 years. Throughout the prehistoric past, the area was used by highly mobile hunters and gatherers who exploited a wide variety of resources. Several thousand cultural sites have been recorded within the PRB.

Frison's (1978, 1991) chronology for the Northwestern Plains divides occupations from early to late into the Paleoindian, Early Plains Archaic, Middle Plains Archaic, Late Plains Archaic, Late Prehistoric, and Protohistoric periods. Frison's chronology is listed below. The Plains designation within the Early, Middle, and Late Archaic periods has been omitted from the list.

- Paleoindian period (13,000 to 7,000 years B.P.)
- Early Archaic period (7,000 to 5,000-4,500 years B.P.)
- Middle Archaic period (5,000-4,500 to 3,000 years B.P.)
- Late Archaic period (3,000 to 1,850 years B.P.)

- Late Prehistoric period (1,850 to 400 years B.P.)
- Protohistoric period (400 to 250 years B.P.)
- Historic period (250 to 120 years B.P.)

The Paleoindian period dates from about 13,000 to 7,000 years ago and includes various complexes (Frison 1978). Each of these complexes is correlated with a distinctive projectile point style derived from a general large lanceolate and/or stemmed point morphology. The Paleoindian period is traditionally thought to be synonymous with "big game hunters" who exploited megafauna such as bison and mammoth (plains Paleoindian groups), although evidence of the use of vegetal resources is noted at a few Paleoindian sites (foothill-mountain groups).

The Early Archaic period dates from about 7,000 to 5,000-4,500 years ago. Projectile point styles reflect the change from large lanceolate types that characterize the earlier Paleoindian complexes to large side- or corner-notched types. Subsistence patterns reflect exploitation of a broad spectrum of resources, with a much-diminished utilization of large mammals.

The onset of the Middle Archaic period (4,500 to 3,000 years B.P.) has been defined on the basis of the appearance of the McKean Complex as the predominant complex on the Northwestern Plains around 4,900 years B.P. (Frison 1978, 1991, 2001). McKean Complex projectile points are stemmed variants of the lanceolate point. These projectile point types continued until 3,100 years B.P. when they were replaced by a variety of large corner-notched points (i.e., Pelican Lake points) (Martin 1999). Sites dating to this period exhibit a new emphasis on plant procurement and processing.

The Late Archaic period (3,000 to 1,850 years B.P.) is generally defined by the appearance of corner-notched dart points. These projectile points dominate most assemblages until the introduction of the bow and arrow around 1,500 years B.P. (Frison 1991). The period witnessed a continual expansion of occupations into the interior grasslands and basins, as well as the foothills and mountains.

The Late Prehistoric period (1,850 to 400 years B.P.) is marked by a transition in projectile point technology around 1,500 years B.P. The large corner-notched dart points characteristic of the Late Archaic period are replaced by smaller corner- and side-notched points for use with the bow and arrow. Around approximately 1,000 years B.P., the entire Northwestern Plains appears to have suffered an abrupt collapse or shift in population (Frison 1991). This population shift appears to reflect a narrower subsistence base focused mainly on communal procurement of pronghorn and bison.

The Protohistoric period (400 to 250 years B.P.) witnesses the beginning of European influence on prehistoric cultures of the Northwestern Plains. Additions to the material culture include most notably the horse and European trade goods, including glass beads, metal, and firearms. Projectile points of this period include

side-notched, tri-notched, and unnotched points, with the addition of metal points. The occupants appear to have practiced a highly mobile and unstable residential mobility strategy.

The historic period (250 to 120 years B.P.) is summarized from Schneider et al. (2000). The use of the Oregon Trail by emigrants migrating to the fertile lands of Oregon, California, and the Salt Lake Valley brought numerous pioneers through the state of Wyoming, but few stayed. It was not until the fertile land in the West became highly populated, along with the development of the cattle industry in the late 1860s, that the region currently comprising the state of Wyoming became attractive for settlement. The region offered cattlemen vast grazing land for the fattening of livestock, which could then be shipped across the country via the recently completed (1867-1868) transcontinental railroad in southern Wyoming.

The settling of the region surrounding Gillette, Wyoming began in the late 1800s, after a government treaty in 1876 placed the Sioux Indians on reservations outside the territory. Cattlemen were the first settlers to establish themselves in the area, with dryland farmers entering the area after 1900. The town of Gillette was established by the railroad in 1891 in an effort to promote the settling of undeveloped areas along their rail lines. The presence of the railroad allowed for the greater development of the cattle industry because it facilitated shipping cattle from the area. Several early ranches established in the region include the 4J Ranch (1875), Half Circle L Ranch (1880s), I Bar U Ranch (1888), and the T7 Ranch (1881). Early ranches established in the region surrounding the project area as of 1883 include the Ritchie Ranch, the McCray Ranch, and the 6 Ranch. Later arrivals to the area (as of 1908) include the Grant Ranch on Hay Creek, the Rooney Ranch on Rawhide Creek, and the Gardner and Wilson Ranches on the Little Powder River. George Oedekoven homesteaded in the area in 1917, and his family still maintains the property today. Site 48CA1918 was homesteaded by Bert Herrod in 1919. This homestead has been abandoned since at least 1983.

The Dry Land Farming movement of the late 19th and early 20th centuries had a profound effect on the settlement of the PRB during the years around World War I. Although the principles of dry land farming were sound, success still required a certain amount of precipitation each year. Wyoming encouraged dry land settlement of its semi-arid lands through a Board of Immigration created in 1911. Newspapers extolled the virtues of dry land farming, and railroads conducted well-organized advertising campaigns on a nationwide basis to settle the regions through which they passed.

The most intensive period of homesteading activity in the Eastern PRB occurred in the late 1910s and early 1920s. Promotional efforts by the state and the railroads, the prosperous war years for agriculture in 1917 and 1918, and the Stock Raising Act of 1916 with its increased acreage (but lack of mineral rights) all contributed to this boom period. A large amount of land filings consisted of existing farms and ranches expanding their holdings in an optimistic economic climate. However, an

equally large number of homesteaders had been misled by promotional advertising and were not adequately prepared for the experiences that awaited them in the PRB. It soon became apparent to the would-be dry land farmer that he could not make a living by raising only crops. Some were initially successful in growing wheat, oats, barley and other small grains, along with hay, alfalfa, sweet clover and other grasses for the increased number of cattle.

A drought in 1919 was followed by a severe winter. The spring of 1920 saw market prices fall. Those homesteaders who were not ruined by the turn in events often became small livestock ranchers and limited their farming to the growing of forage crops and family garden plots. Some were able to obtain cheap land as it was foreclosed or sold for taxes. During the 1920s the size of homesteads in Wyoming nearly doubled and the number of homesteads decreased, indicating the shift to livestock raising (LeCompte and Anderson 1982).

With serious drought beginning in 1932, several federal actions were taken. In April of 1932, Weston, Campbell, and Converse counties were eligible for a drought relief program. The Northeast Wyoming Land Utilization Project began repurchasing the sub-marginal homestead lands and making the additional acres of government land available for lease. This helped the small operator to expand the usable grazing land. Cropland taken out of production could be reclaimed and then added to the grazing lease program. Grazing associations were formed to regulate the grazing permits. In 1934, the Agricultural Adjustment Administration began studying portions of Converse, Campbell, Weston, Niobrara, and Crook counties. In all, 2 million acres were included in the Thunder Basin Project (LA-WY-1) to alter land use and to relocate settlers onto viable farmland. Nationally, the program hoped to shift land use from farms to forest, parks, wildlife refuges or grazing districts. In marginal areas cash crops were to be replaced by forage crops, the kind and intensity of grazing would be changed and the size of operating units would be expanded (USFS n.d.). Land purchase work on the Thunder Basin Project began late 1934 and the purchasing of units started in 1935.

During the development program to rehabilitate the range, impounding dams were erected, wells were repaired, springs developed, and homestead fences were obliterated while division fences were constructed for the new community pastures. Farmsteads were obliterated and the range reseeded. Remaining homesteaders and ranchers often purchased or scavenged materials from the repurchased farmsteads. Pits were dug on some homesteads and machinery and demolished buildings buried (many of these were dug up during the World War II scrap drives). Ironically, the rehabilitation project utilized a labor pool of former farmers who had spent years building what the government paid them to destroy. Their efforts were so successful that almost no trace remains of many homesteads.

While counties lost much of their population base as a result of the Resettlement Administration relocation program, they were strengthened financially: schools

were closed, maintenance of rural roads was restricted to main arterioles, and delinquent taxes were paid. The remaining subsidized ranches were significantly larger and provided a stabilizing effect on the local economies. Three grazing associations were formed: the Thunder Basin Grazing Association, the Spring Creek Association, and the Inyan Kara Grazing Association. These associations provided responsible management of the common rangeland.

Class III Cultural Resources Survey

A Class III cultural resources survey is an intensive and comprehensive inventory of a proposed project area conducted by professional archaeologists and consultants. The survey is designed to locate and identify all prehistoric and historic cultural properties 50 years and older that have exposed surface manifestations. The goal of the survey is to locate and evaluate for the National Register of Historic Places (NRHP) all cultural resources within the project area. Cultural properties are recorded at a sufficient level to allow for evaluation for possible inclusion to the NRHP. Determinations of eligibility are made by the managing federal agency in consultation with the State Historic Preservation Office (SHPO). Consultation with the SHPO must be completed prior to the approval of the mining plan.

After completion of a Class III cultural resources survey, additional investigations may be undertaken to complete an individual site record. If necessary, site-specific testing or limited excavation may be utilized to collect additional data which will: 1) determine the final evaluation status of a site; and/or 2) form the basis of additional work to be conducted during implementation of a treatment plan if the site is determined eligible for the NRHP. A treatment plan is then developed for those sites that are eligible for the NRHP and are within the area of potential effect. Treatment plans are implemented prior to mining and can include such mitigation measures as avoidance (if possible), large scale excavation, complete recording, Historical American Building Survey/Historic American Engineering Record documentation, archival research, and other acceptable scientific practices.

Data recovery plans are required for sites that are recommended as eligible for the NRHP and cannot be avoided by project development, following testing and consultation with the SHPO. Until consultation has occurred and agreement regarding NRHP eligibility has been reached, all sites recommended as eligible or undetermined eligibility must be protected from disturbance. Full consultation with the SHPO will be completed prior to approval of the mining plans. Those sites determined to be unevaluated or eligible for the NRHP through consultation would receive further protection or treatment.

Numerous Class I (survey records review) and Class III cultural resource surveys associated with oil and gas field development and surface mining operations have been conducted in the general area.

3.12.1.1 Belle Ayr North LBA Tract

FCW contracted with TRC Mariah Associates, Inc. of Laramie, Wyoming to perform Class I and Class III surveys of the Belle Ayr North LBA tract and surrounding area in 2006. The 2006 Class I survey covered the BLM study area (the LBA tract as applied for under the Proposed Action and the additional area evaluated under Alternative 2). The Class III survey area included previously unsurveyed areas within the original BLM study area.

The Belle Ayr North LBA tract cultural resource analysis area has been entirely surveyed for cultural resources at a Class I level. The Class I review of previous survey records identified 11 archeological sites, of which seven are prehistoric, two are historic, and two are multi-component. Prehistoric sites consist primarily of open camps and lithic scatters. All prehistoric sites are considered not eligible. Historic sites consist primarily of homesteads. The two historic sites are not considered eligible to the NRHP. The two multi-component sites consist mostly of lithic and historic debris and are considered not eligible. No isolated occurrences were identified during the Class I records search.

All of the remainder of the Belle Ayr North cultural resources general analysis area was surveyed at a Class III level in 2006, 2008, and 2009. One archaeological site and five isolated occurrences were identified and recorded during the recent Class III inventories. The five isolates consist of prehistoric flakes and projectile points. The one newly recorded cultural site consists of a prehistoric open campsite and is considered not eligible for the NRHP. Two previously recorded sites (48CA1918 and 48CA3222) located within the analysis area were reassessed during the 2006 inventory. Site 48CA1918 consisted of a historic homestead and ranch was originally recommended as eligible the NRHP. Subsequent evaluations of this site in 1999 and 2006 found the site destroyed and it was recommended that it no longer be eligible for listing on the NRHP due to the loss of site integrity. Site 48CA3222 consisted of prehistoric lithic scatter and was originally considered not eligible for the NRHP. The site could not be relocated in 2006 due to the dense ground cover in the area. Areas within the analysis area that had been surveyed prior to 1980, including four previously identified sites (48CA2394, 48CA2397, 48CA2398, and 48CA6381), were reassessed in 2008. No cultural material was recovered. Three small parcels within the general analysis area not included in previous Class III level surveys were surveyed in 2009. No cultural material was recovered.

To summarize the identified cultural properties, a total of 12 archaeological sites are located in the Belle Ayr North LBA tract cultural survey area. Of these 12 sites, eight are prehistoric, two are historic, and two are multi-component. None of the 12 sites are recommended as eligible to the NRHP. Five prehistoric isolated occurrences were also recorded. Approximately 54 acres of the 1,947 acre Belle Ayr North cultural resources general analysis area have not been surveyed at a Class III level. Some areas previously surveyed at a Class III level were surveyed

prior to 1980 and were thought to be considered substandard in terms of current methodology. These areas were resurveyed in 2008.

3.12.1.2 West Coal Creek LBA Tract

TBCC contracted with ACR Consultants, Inc. of Sheridan, Wyoming to perform Class I and Class III surveys of the West Coal Creek LBA tract and surrounding area in 2007. The 2007 Class I survey was larger than and included the West Coal Creek cultural resources general analysis area. The 2007 Class III survey included the entire BLM study area.

The Class I review of previous survey records identified six archeological sites, of which five are prehistoric and one is multi-component within the West Coal Creek cultural resources general analysis area. The prehistoric sites include three lithic scatters, one lithic scatter with hearth, and one hearth. The multi-component site consists of lithic scatter with historic debris. None of the sites are considered eligible for the NRHP, although fives sites were unevaluated for NRHP eligibility. A total of five isolated occurrences (all prehistoric) were identified during the Class I records search.

ACR recorded nine new sites during the Class III surveys, which covered the BLM study area. Five sites are prehistoric and four are multi-component. The prehistoric sites include two lithic scatters, two lithic scatters with hearths, and one habitation locale with cairns. The site containing cairns was identified as having potential significance to Native American tribes. BLM initiated consultation with several tribes (Northern Cheyenne, Crow, Three Affiliated Tribes, Oglala Sioux, Standing Rock Sioux, Fort Peck Assiniboine/Sioux, Eastern Shoshone and Northern Arapaho) and the Northern Cheyenne Tribe expressed interest in visiting the site. BLM cannot make a determination of eligibility for the site until an onsite with tribal representatives is conducted and consultation is completed. The multi-component sites consist two lithic scatter with historic debris and two prehistoric habitation locales with historic debris. All sites are considered not eligible. A total of 21 new isolated finds (17 prehistoric and four historic) during the Class III survey. ACR also revisited the four previously recorded sites within the BLM study area. Two of the sites were subsequently combined into one site, and one site was not found and was removed from the list of existing sites.

Based on the Class I and Class III surveys, 15 archaeological sites have been verified within the West Coal Creek LBA cultural resource analysis area. Only 13 sites could be verified (one site could not be found in the field and one site was combined with another site). Of these sites, eight are prehistoric and five are multi-component. None of the 13 verified sites are considered eligible for the NRHP, but one site within the ¼-mile buffer is unevaluated for NRHP eligibility. A total of 26 isolated occurrences were recorded within the analysis area. The entire BLM study area has been surveyed to current standards. Some areas previously

surveyed at a Class III level were surveyed prior to 1980 and were thought to be considered substandard in terms of current methodology.

3.12.1.3 Caballo West LBA Tract

In 2006, Powder River Coal, LLC, Gillette, Wyoming contracted GCM Services to conduct a Class I cultural resource inventory (records search) for the Caballo Mine, consisting of a contiguous block encompassing approximately 27,520 acres. The Caballo West cultural resources general analysis area, comprising roughly 1,390 acres, is wholly contained within the 2006 Class I inventory area. The Class I review of previous survey records identified seven archeological sites, of which five are prehistoric, one is historic, and one is multi-component, within the Caballo West cultural resources general analysis area. Prehistoric sites consist primarily of lithic scatters and open camps. All prehistoric sites are considered not eligible. Historic sites consist primarily of homesteads and trash dumps. The historic site is considered not eligible. The one multi-component site consists of an open camp and homestead and is considered not eligible. A total of seven isolated occurrences were identified during the Class I records search. The four prehistoric isolates consist of two projectile point/tools and two historic debris items. The three historic isolates consist of trash scatters.

A majority of the Caballo West LBA tract cultural survey area has been surveyed for cultural resources at a Class III level. Approximately 220 acres of the 1,390 acre Caballo West Cultural resources general analysis area have not been surveyed at a Class III level and approximately 360 acres were surveyed at a Class III level in 1975 and are considered substandard in terms of current methodology.

3.12.1.4 Maysdorf II LBA Tract

CMC contracted with TRC Mariah Associates, Inc. of Laramie, Wyoming to perform Class I and Class III surveys of the Maysdorf II LBA tract and surrounding area in 2007. The 2007 Class I survey was larger than and included the Maysdorf II cultural resources general analysis area. Areas identified as not having been surveyed at a Class III level were surveyed at that level later in 2007.

The Class I review of previous survey records identified 33 archeological sites, of which 20 are prehistoric, 12 are historic, and one is multi-component. Prehistoric sites consist primarily of open camps, stone circles/cairns, and lithic scatters. Fifteen of the prehistoric sites are considered not eligible to the NRHP, two remain unevaluated, and three are considered eligible to the NRHP. The site containing stone circles and the cairn site was identified as having potential significance to Native American tribes. BLM initiated consultation with several tribes (Northern Cheyenne, Crow, Three Affiliated Tribes, Oglala Sioux, Standing Rock Sioux, Fort Peck Assiniboine/Sioux, Eastern Shoshone and Northern Arapaho) and the Northern Cheyenne Tribe expressed interest in visiting the site. BLM cannot make a determination of eligibility for the site until an onsite with tribal representatives

is conducted and consultation is completed. Historic sites consist primarily of homesteads, trash dumps, and historic trails. Four historic trails (Hay Creek-Porcupine Road, Hathaway's-Black Hills Trail, Sawyer's Expedition Trail, and Crook's Military Trail) and one homestead are considered eligible to the NRHP. Seven historic sites are considered not eligible. The one multi-component site is a lithic and trash scatter and is unevaluated. A total of 13 isolated occurrences were identified during the Class I records search. The isolates consist of prehistoric flakes and tools.

The remainder of the Maysdorf II cultural resources general analysis area was surveyed at a Class III level in 2007. A total of eight archaeological sites and 16 isolated occurrences were identified and recorded during this recent Class III inventory. The eight newly recorded cultural sites consist of five historic sites (two homesteads, a windmill, a trash scatter, and a cemetery) and three prehistoric sites, including a cairn with artifacts, a stone circle site, and a lithic scatter. The remains within the cemetery have since been relocated in accordance with all applicable laws and regulations and following negotiations with the Campbell County Cemetery District and representatives for the Haight Family. Six archaeological sites will be recommended as not eligible. The 16 isolates consist of nine localities of prehistoric flakes and tools and seven localities of historic debris items.

To summarize the identified cultural properties, a total of 41 archaeological sites are located in the Maysdorf II cultural resources general analysis area. Of these 41 sites, 23 are prehistoric, 17 are historic, and one is multi-component. A total of eight sites are considered eligible to the NRHP. These sites include the four historic trails (Hay Creek-Porcupine Road, Hathaway's-Black Hills Trail, Sawyer's Expedition Trail, and Crook's Military Trail), one homestead, and three prehistoric open campsites. A total of 10 sites remain unevaluated to the NRHP. Twenty-two sites have either been determined or are recommended as not eligible to the NRHP. One site (Maysdorf Point Cemetery) was listed as not recorded and the remains within the cemetery have been relocated. Twenty-two prehistoric isolated finds and seven historic isolated finds were also recorded. The entire Maysdorf II cultural resources general analysis area has been surveyed for cultural resources at a Class III level.

3.12.2 Environmental Consequences

3.12.2.1 Proposed Action and Alternatives 2 and 3

Data recovery plans are required for sites that are recommended eligible to the National Register and cannot be avoided, following testing and consultation with the SHPO. In the case of a maintenance lease for an existing mine, full consultation with SHPO must be completed prior to approval of the MLA mining plan amendment for the mine. At that time, those sites determined to be unevaluated or eligible for the NRHP through consultation receive further

protection or treatment. Impacts to eligible or unevaluated cultural resources cannot be permitted. Eligible sites that cannot be avoided or that have not already been subjected to data recovery action are carried forward in the mining plan as requiring protective stipulations until a testing, mitigation, or data recovery plan is developed to address the impacts to the sites. Unevaluated sites that cannot be avoided must be evaluated prior to disturbance. Ineligible properties may be destroyed without further work.

Any eligible sites on the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts that cannot be avoided or that have not already been subjected to data recovery action would be carried forward in the mining and reclamation plans as requiring protective stipulations until a testing, mitigation, or data recovery plan is developed to address the impacts to the sites. The lead federal and state agencies would consult with Wyoming SHPO on the development of such plans and the manner in which they are carried out.

Cultural resources adjacent to the mine areas may be impacted as a result of increased access to the areas. There may be increased vandalism and unauthorized collecting associated with recreational activity and other pursuits outside of but adjacent to mine permit areas.

3.12.2.2 No Action Alternative

Under the No Action alternative, the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications would be rejected and coal removal and associated disturbance and impacts would not occur on the additional acres that would be disturbed under the Proposed Action or other action alternatives for each tract. Currently approved mining operations would continue on the existing Caballo, Belle Ayr, Cordero Rojo, and Coal Creek Mine leases. Impacts to cultural resources related to mining operations at these mines would not be extended onto portions of the LBA tracts that will not be affected under the current mining and reclamation plan.

As discussed in chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA lease applications at this time would not preclude an application to lease the tracts in the future.

3.12.3 Native American Consultation

Native American heritage sites can be classified as prehistoric or historic. Some may be presently in use as offering, fasting, or vision quest sites. Other sites of cultural interest and importance may include rock art, stone circles, various rock features, fortifications or battle sites, burials, and locations that are sacred or part of the oral history and heritage but have no man-made features.

No Native American heritage, special interest, or sacred sites have been formally identified and recorded to date within the general South Gillette analysis area. However, the geographic position of the general South Gillette analysis area between mountains considered sacred by various Native American cultures (the Big Horn Mountains to the west, the Black Hills to the east, and Devils Tower to the north) creates the possibility that existing locations may have special religious or sacred significance to Native American groups. If such sites or localities are identified at a later date, appropriate action must be taken to address concerns related to those sites.

Tribes that have been identified as potentially having concerns about actions in the PRB include the Crow, Northern Cheyenne, Shoshone, Arapaho, Oglala Sioux, Rosebud Sioux, Crow Creek Sioux, Lower Brule Sioux, Standing Rock Sioux, Cheyenne River Sioux, Apache Tribe of Oklahoma, Comanche Tribe of Oklahoma, and Kiowa Tribe of Oklahoma. These tribal governments and representatives have been sent copies of the EIS. They have also been provided with more specific information about the known cultural sites on the tract in this analysis. Their help has been requested in identifying potentially significant religious or cultural sites in the general South Gillette analysis area.

Native American tribes were consulted at a general level in 1995-1996 as part of an update to the BLM *Buffalo Resource Area RMP*. Some of the Sioux tribes were consulted by BLM on coal leasing and mining activity in the PRB at briefings held in Rapid City, South Dakota in March 2002.

3.12.4 Regulatory Compliance, Mitigation and Monitoring

Class I and III surveys are conducted to identify cultural properties on all lands affected by federal undertakings. Prior to any mining disturbance, SHPO is consulted to evaluate the eligibility of the cultural properties for inclusion in the NRHP. Cultural properties that are determined to be eligible for the NRHP are avoided or, if avoidance is not possible, a recovery plan is implemented prior to disturbance.

Mining activities are monitored during topsoil stripping operations. If a lease is issued for the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II LBA tracts, BLM would attach a stipulation to each lease requiring the lessee to notify appropriate federal personnel if cultural materials are uncovered during mining operations (appendix D).

3.12.5 Residual Impacts

Cultural sites that are determined to be eligible for the NRHP would be avoided if possible. Eligible sites that cannot be avoided would be destroyed by surface coal mining after data from those sites is recovered. Sites that are not eligible for the NRHP would be lost.

Cultural sites are permanently destroyed by surface coal mining operations but, as a result of the intensive pedestrian inventories, site evaluations and excavation and analysis of prehistoric cultural resources discussed above, there is a more informed understanding of what types of resources exist in the region and a better understanding of local prehistory.

3.13 Visual Resources

3.13.1 Affected Environment

Visual sensitivity levels are determined by people's concern for what they see and the frequency of travel through an area. Landscapes within the general South Gillette analysis area include rolling sagebrush and short-grass prairie, which are common throughout the PRB. There are also areas of altered landscape, such as oil fields and surface coal mines. The existing active surface mines that are located on the eastern side of the PRB form three geographic groups that are separated by areas with no mining operations (figure 1-1). Two of the groups of surface mines are located east of Highway 59 from south of Gillette to south of Wright; the third mine group is located on the east side of U.S. Highway 14-16 from Gillette north for about 13 miles. Other man-made intrusions include ranching activities (fences, homesteads, and livestock), oil and gas development (pumpjacks, pipeline rights-of-way, CBNG well shelters, and CBNG compressor stations), transportation facilities (roads and railroads), environmental monitoring installations, road signage, and electrical power transmission lines. The natural scenic quality in and near the immediate lease area is fairly low because of the industrial nature of the adjacent existing mining operations and oil and gas development.

Visual resource management (VRM) guidelines for BLM lands are to manage public lands for current VRM classifications and guidelines. The VRM system is the basic tool used by BLM to inventory and manage visual resources on public lands. The VRM classes constitute a spectrum ranging from Class I through Class V that provides for increasing levels of change within the characteristic landscape.

The inventoried lands were classified into VRM classes as follows:

Class I – Natural ecologic changes and very limited management activity is allowed. Any contrast (activity) within this class must not attract attention.

Class II – Changes in any of the basic elements (form, line, color, texture) caused by an activity should not be evident in the landscape.

Class III – Contrasts to the basic elements caused by an activity are evident but should remain subordinate to the existing landscape.

Class IV – Activity attracts attention and is a dominant feature of the landscape in terms of scale.

Class V – This classification is applied to areas where the natural character of the landscape has been disturbed up to a point where rehabilitation is needed to bring it up to the level of one of the other four classifications.

For management purposes, BLM evaluated the visual resources on lands under its jurisdiction in the 2001 BLM Buffalo RMP update (BLM 2001a). In the general South Gillette analysis area, the predominant VRM classifications are Class IV for lands not yet disturbed by mining and Class V for lands that have already been disturbed by mining. For lands classified as VRM Class IV, activities, such as mining, attract attention and are dominant features of the landscape in terms of scale. Class V applies to areas where the natural character of the landscape has been disturbed up to a point where rehabilitation is needed to bring it up to the level of one of the other four classifications.

Currently, mine facilities and mining activities at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines are visible from various public-use roads in the general South Gillette analysis area, including State Highway 59, Bishop Road, Hoadley Road, Hilight Road, and T-7 Road.

3.13.2 Environmental Consequences

3.13.2.1 Proposed Action and Alternatives 2 and 3

Portions of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts are visible from State Highway 59, which is adjacent to the Maysdorf II Tract and from 2 to 3 miles west of the other three tracts. Therefore, some mining activities on the LBA tracts would be visible from this major travel route. Portions of each LBA tract would also be visible from Hilight Road, T-7 Road, Hoadley Road, Bishop Road, or Haight Road.

If the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts are leased and mined, the portions of the general South Gillette analysis area that would be disturbed under the Proposed Action or other action alternatives for each tract would be considered as VRM Class V prior to reclamation. After reclamation of the LBA tracts and adjoining mines, the areas classified as Class V would improve to resemble the surrounding undisturbed terrain. No visual resources that are unique to this area have been identified on or near the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts.

Reclaimed terrain would be almost indistinguishable from the surrounding undisturbed terrain. Slopes might appear smoother (less intricately dissected) and gentler (less steep) than undisturbed terrain and sagebrush would not be as abundant for several years; however, within a few years after reclamation, the

mined land would not be distinguishable from the surrounding undisturbed terrain except by someone very familiar with landforms and vegetation.

3.13.2.2 No Action Alternative

Under the No Action alternative, the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications would be rejected and coal removal and associated disturbance and impacts would not occur on the additional acres that would be disturbed under the Proposed Action or other action alternatives for each tract and the current VRM Class IV and V designations would not change for those lands. Currently approved mining operations would continue on the existing Caballo, Belle Ayr, Cordero Rojo, and Coal Creek Mine leases. Impacts to visual resources related to mining operations at these mines would not be extended onto portions of the LBA tracts that will not be affected under the current mining and reclamation plan.

As discussed in chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA lease applications at this time would not preclude an application to lease the tracts in the future.

3.13.3 Regulatory Compliance, Mitigation and Monitoring

Landscape character would be restored during reclamation to approximate original contour and would be reseeded with an approved seed mixture, including native species.

See section 3.2 and section 3.9 for additional discussion of the regulatory requirements, mitigation, and monitoring for topography and vegetation.

3.13.4 Residual Impacts

No residual impacts to visual resources are expected.

3.14 Noise

3.14.1 Affected Environment

Existing noise sources in the general South Gillette analysis area include coal mining activities, traffic on the nearby highways and county roads, rail traffic, aircraft traffic to and from the nearby airport, wind, and CBNG compressor stations. Noise originating from CBNG development equipment (e.g., drilling rigs and construction vehicles) is apparent locally over the short term (i.e., 30 to 60 days) where well drilling and associated construction activities are occurring. The amount of noise overlap between well sites is variable and depends on the timing of drilling activities on adjacent sites and the distance between the site locations.

Studies of background noise levels indicate that ambient sound levels generally are low at many of the PRB mines, owing to the isolated nature of the area. The unit of measure used to represent sound pressure levels (decibels) using the A-weighted scale is a dBA. It is a measure designed to simulate human hearing by placing less emphasis on lower frequency noise because the human ear does not perceive sounds at low frequency in the same manner as sounds at higher frequencies. Figure 3-40 presents noise levels associated with some commonly heard sounds.

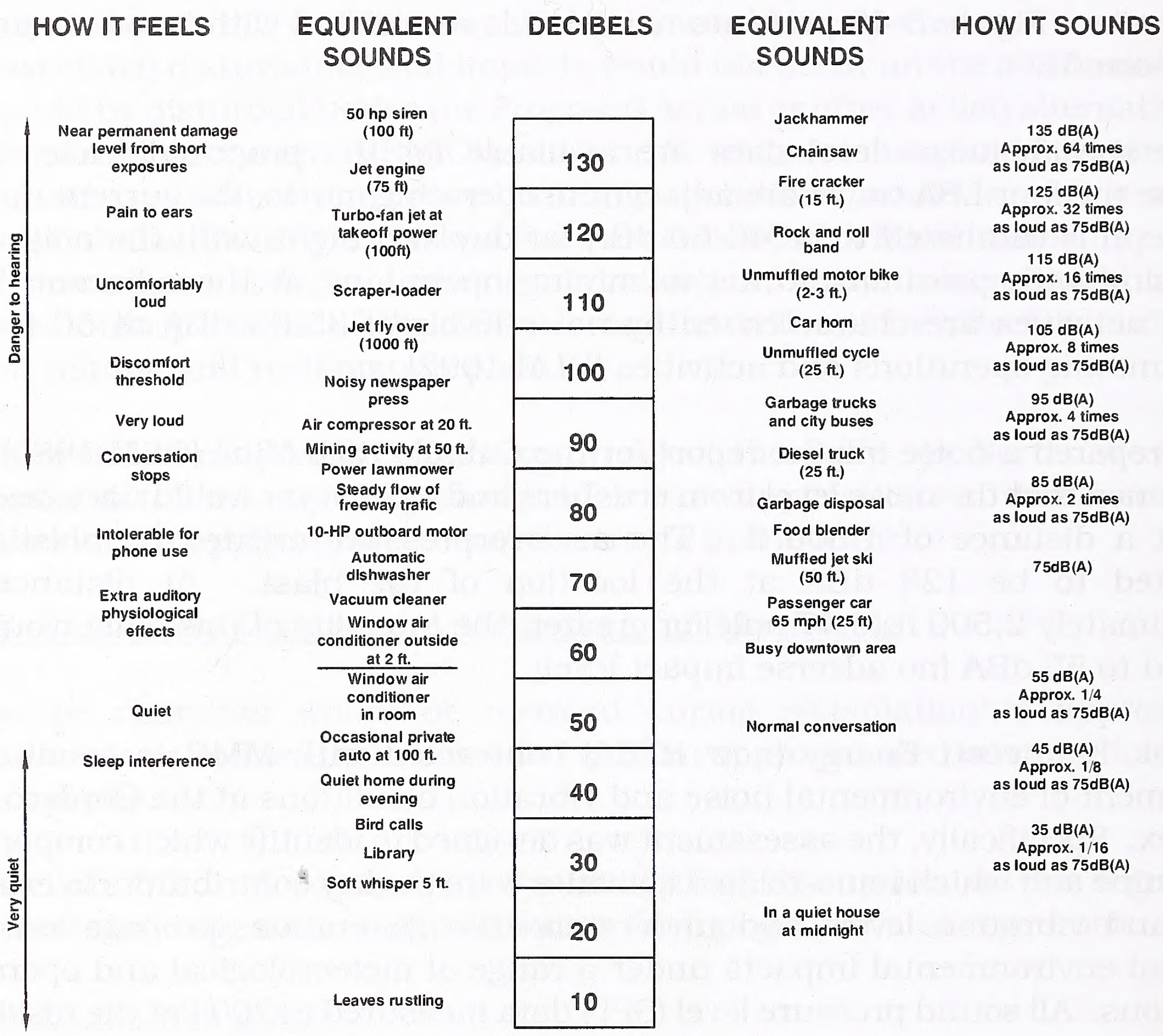
No site-specific noise level data are available for the proposed lease areas. Because the four LBA tracts are adjacent to operating mines, the current median noise level is estimated to be 40-60 dBA for day and night, with the noise level increasing with proximity to active mining operations at the adjacent mine. Mining activities are characterized by noise levels of 85-95 dBA at 50 ft from actual mining operations and activities (BLM 1992).

OSM prepared a noise impact report for the Caballo Rojo Mine (OSM 1980) that determined that the noise level from crushers and a conveyor would not exceed 45 dBA at a distance of 1,500 ft. The air overpressure created by blasting is estimated to be 123 dBA at the location of the blast. At distances of approximately 2,500 ft (0.47 mile) or greater, the intensity of this blast would be reduced to 55 dBA (no adverse impact level).

In 2004, Kennecott Energy (now RTEA) contracted with MMC to conduct an assessment of environmental noise and vibration conditions at the Cordero Rojo complex. Specifically, the assessment was designed to identify which components of the mine and which mine-related activities were the key contributors to external noise and vibration levels and understand the generation, propagation, and potential environmental impacts under a range of meteorological and operating conditions. All sound pressure level (SPL) data measured in 2004 at the residence nearest to mining activity met EPA standards for suitable living. All blasting events were found to be in compliance with OSMRE and USBM safe blasting levels.

The nearest occupied dwellings to the four LBA tracts include in this analysis are presented in table 3-18.

Figures 3-10, 3-13, 3-16, and 3-19 depict the locations of occupied residences with respect to the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts, respectively.



Adapted From ABC's of Our Noise Codes published by Citizens Against Noise, Honolulu, Hawaii

Figure 3-40. Relationship Between A-Scale Decibel Readings and Sounds of Daily Life.

Table 3-18. Noise Related Impacts for the SGAC LBA Tracts.

LBA Tract	# of Dwellings Within 3 Miles		Distance to Closest Dwelling (ft)	Max Noise Level to Closest (dBA)	Potential Impacts
	Single Family	Multiple Family			
Belle Ayr North	25	2	4,080	51	NAI*
West Coal Creek	12	0	960	63	PI*
Caballo West	41	2	3,160	53	NAI
Maysdorf II	35	1	2,275	56	PI

* NAI: No adverse impact (24-hour equivalent level of less than or equal to 55 dBA)
PI: Potential Impacts - no hearing loss (24-hour equivalent level of less than 70 dBA)

3.14.2 Environmental Consequences

3.14.2.1 Proposed Action and Alternatives 2 and 3

Noise levels on the LBA tracts would be increased considerably by mining activities such as blasting, loading, hauling, and possibly in-pit crushing. Since the LBA tracts would be mined as an extension of existing operations under the Proposed Action or other action alternatives for each tract, no rail car loading would take place on the LBA tracts. Under the authority of the Noise Control Act of 1972, EPA designates that a 24-hour equivalent level of less than 70 dBA prevents hearing loss and that a level at or below 55 dBA, in general, does not constitute an adverse impact (EPA 1974).

Potential blasting related noises impacts for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts are presented in table 3-18. Because of the remoteness of the LBA tracts and because mining is already on going in the area, noise would have few off-site impacts.

Wildlife in the immediate vicinity of mining may be adversely affected by the noise of the mining operations. Anecdotal observations at surface coal mines in the area suggest that some wildlife may adapt to increased noise associated with coal mining activity. After mining and reclamation are completed, noise would return to premining levels.

3.14.2.2 No Action Alternative

Under the No Action alternatives, coal removal and the associated noise impacts would not occur on the additional acres that would be disturbed under the Proposed Action or other action alternatives for each tract. Currently approved mining operations and associated noise impacts would continue on the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine leases. Noise impacts related to mining operations at these mines would not extend onto portions of the LBA tracts that will not be affected under the current mining and reclamation plan.

As discussed in chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.14.3 Regulatory Compliance, Mitigation and Monitoring

Mine operators are required to comply with MSHA regulations concerning noise, which include protecting employees from hearing loss associated with noise levels at the mines. MSHA periodically conducts mine inspections to ensure compliance with the requirements of the Federal Mine Safety and Health Act of 1977.

3.14.4 Residual Impacts

No residual impacts to noise are expected.

3.15 Transportation

3.15.1 Affected Environment

Transportation resources near the general South Gillette analysis area include State Highway 59, five improved two-lane county roads (Haight Road, T-7 Road, Hilight Road, Hoadley Road, and Bishop Road), several unimproved local roads and accesses (unnamed two-track trails), the Gillette-Douglas rail line used jointly by BNSF & UP Railroads, oil and gas pipelines, utility/power lines, telephone lines, and associated rights-of-way. Figures 3-41 through 3-44 depict the current transportation facilities, excluding the oil and gas pipelines, within and near the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts, respectively. Figures 3-45 through 3-48 depict the oil and gas pipelines within and near the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts, respectively.

State Highway 59 is the major north-south public transportation corridor in this area. Principal east-west public transportation corridors are the Haight and T-7 Roads, which cross the Cordero Rojo Mine's permit area, and the Wagensen/Hoadley Road, which accesses the Coal Creek mines from the west. North-south access to the general South Gillette analysis area is on the Bishop Road, which crosses between the Caballo and Belle Ayr mines and the Hilight Road accesses the Cordero Rojo Mine from the south. The highway and some improved roads provide public and private access within the general South Gillette analysis area. The unimproved local roads and accesses in the area are for both public and private use.

Coal extracted from the existing surface coal mines in the Wyoming PRB, including the four applicant mines in the general South Gillette analysis area, is transported in rail cars along the BNSF and UP rail lines. The coal mines north of Gillette ship most of their coal via the east-west BNSF rail line that runs through

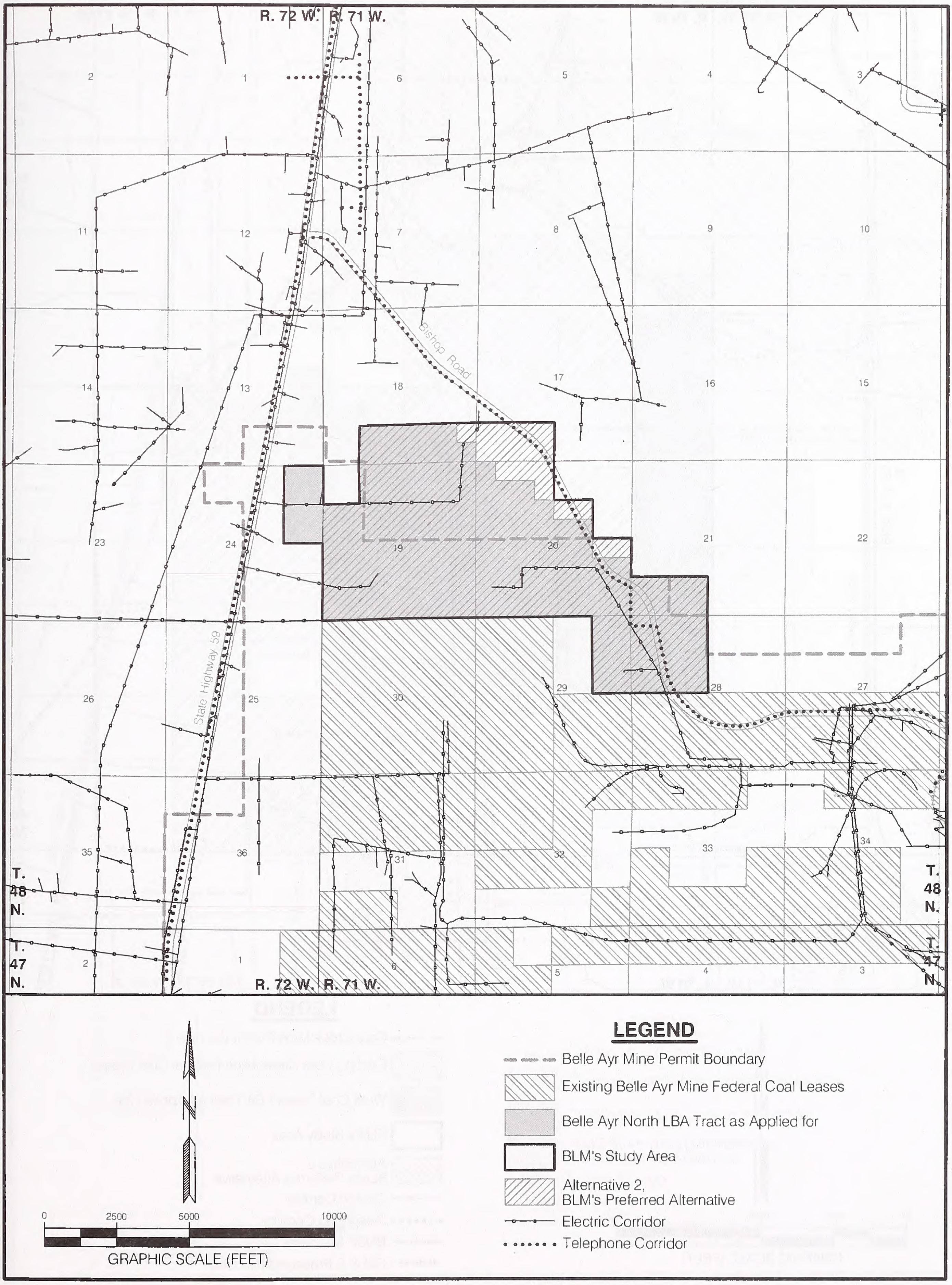


Figure 3-41. Transportation Facilities Within and Adjacent to the Belle Ayr North LBA Tract.

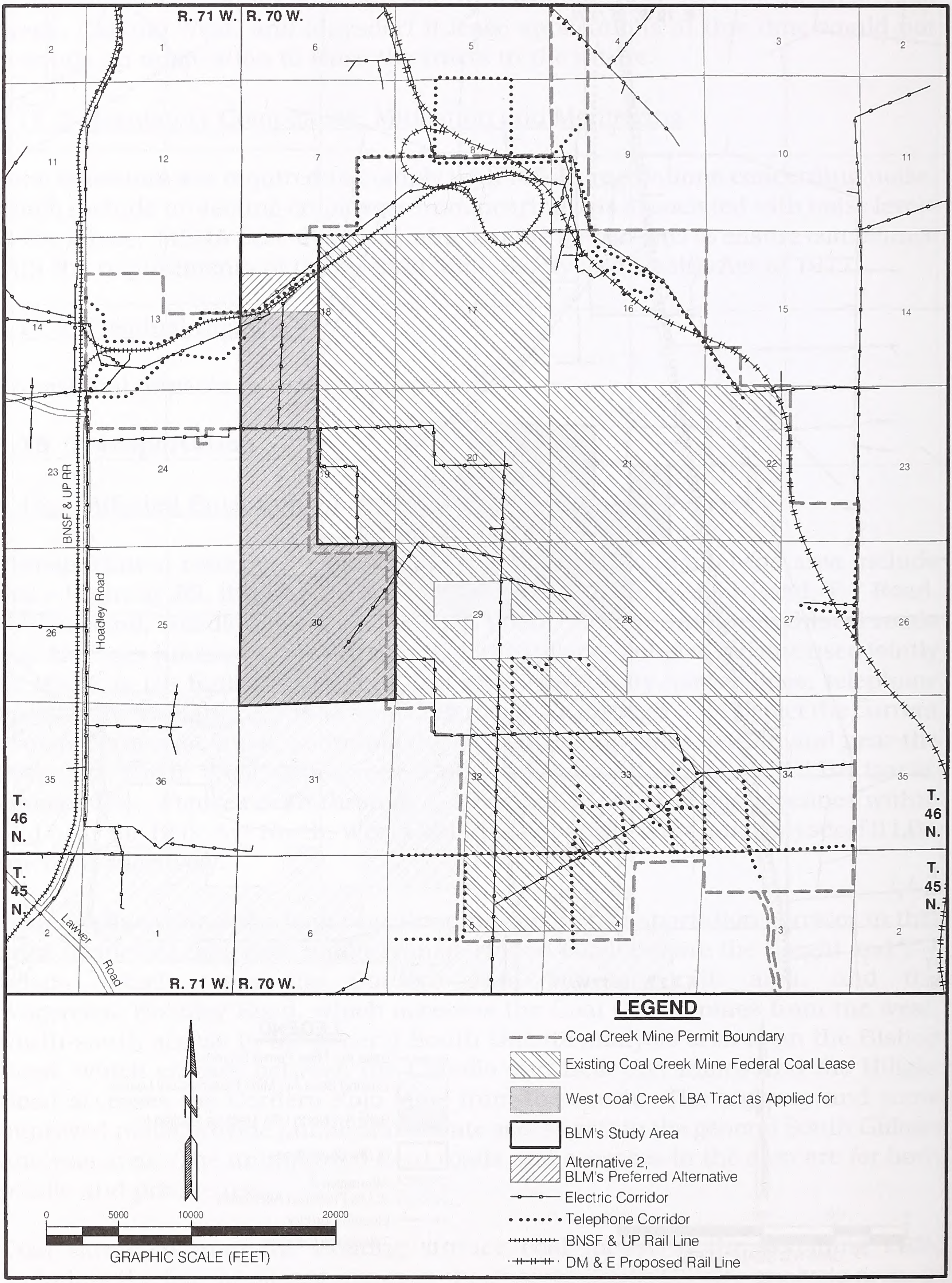


Figure 3-42. Transportation Facilities Within and Adjacent to the West Coal Creek LBA Tract.

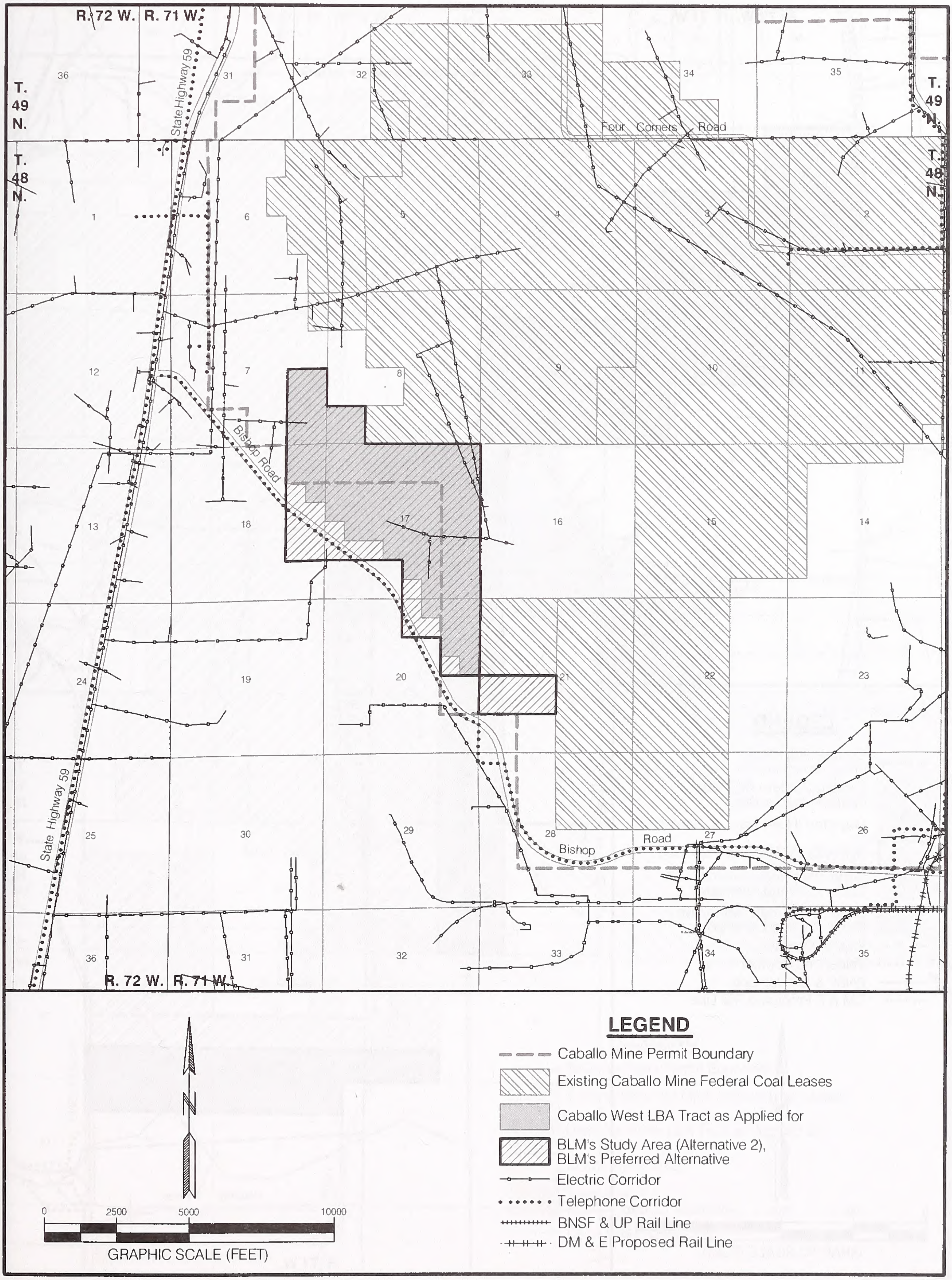


Figure 3-43. Transportation Facilities Within and Adjacent to the Caballo West LBA Tract.

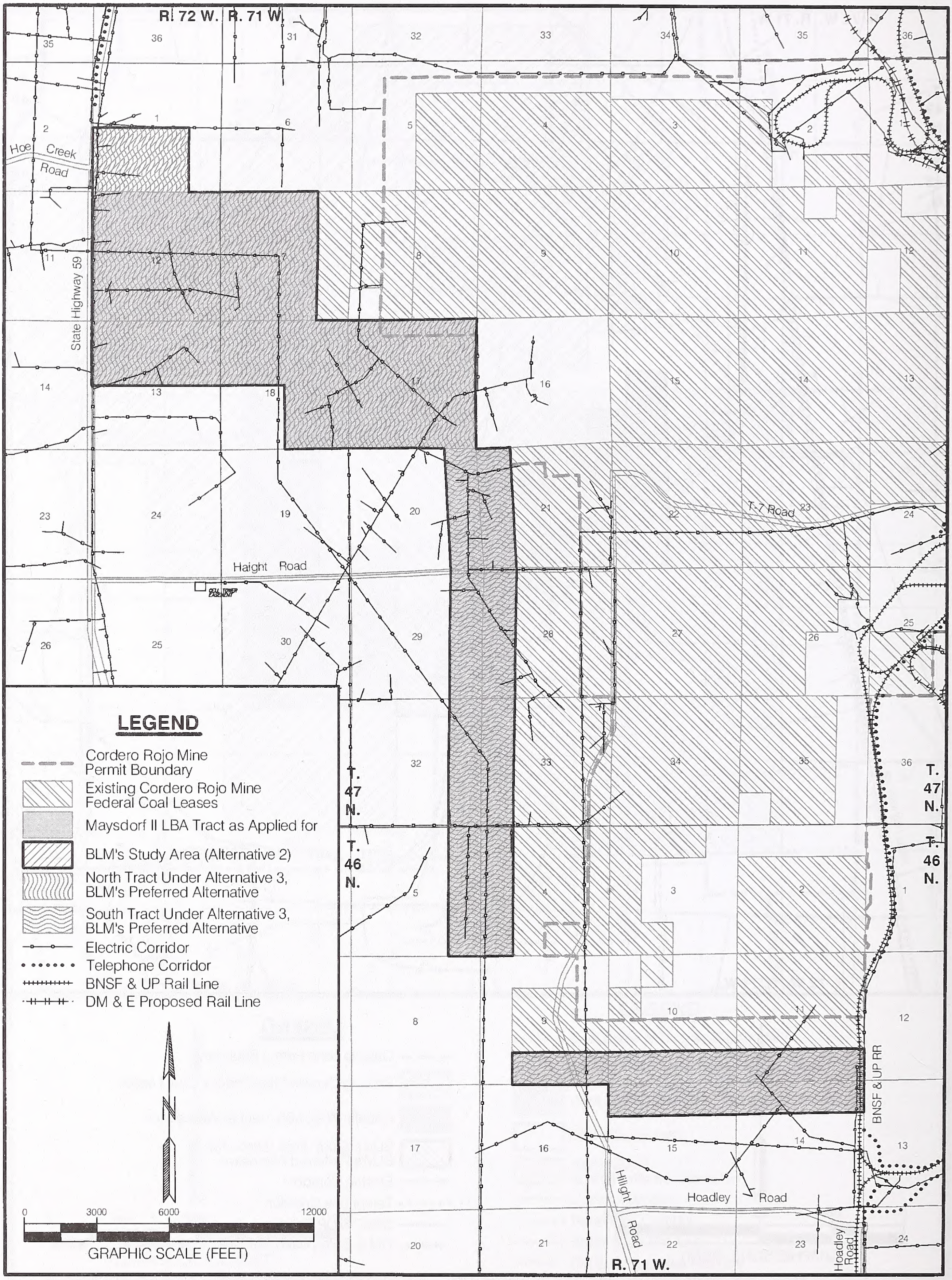


Figure 3-44. Transportation Facilities Within and Adjacent to the Maysdorf II LBA Tract.

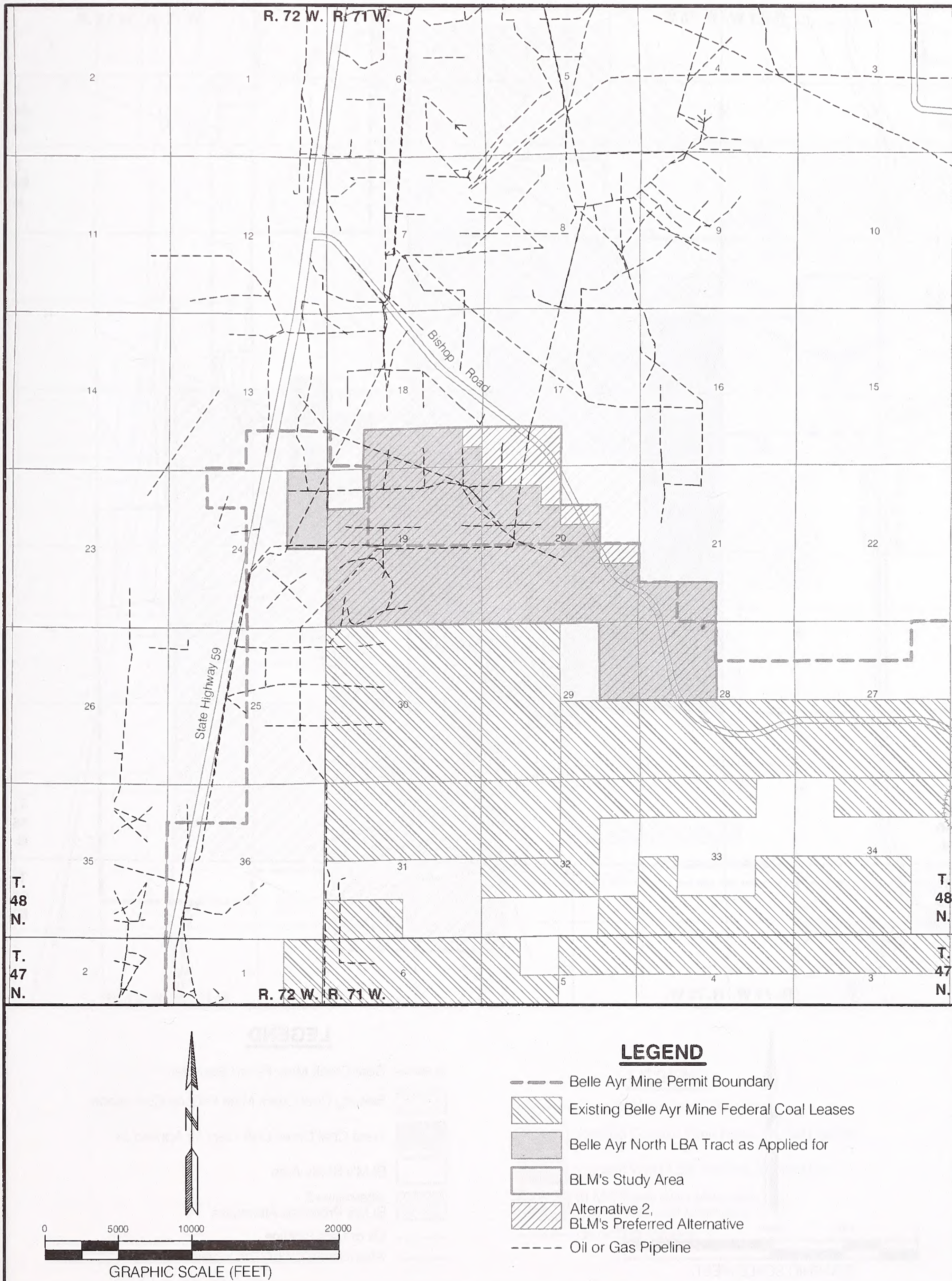


Figure 3-45. Oil and Gas Pipelines Within and Adjacent to the Belle Ayr North LBA Tract.

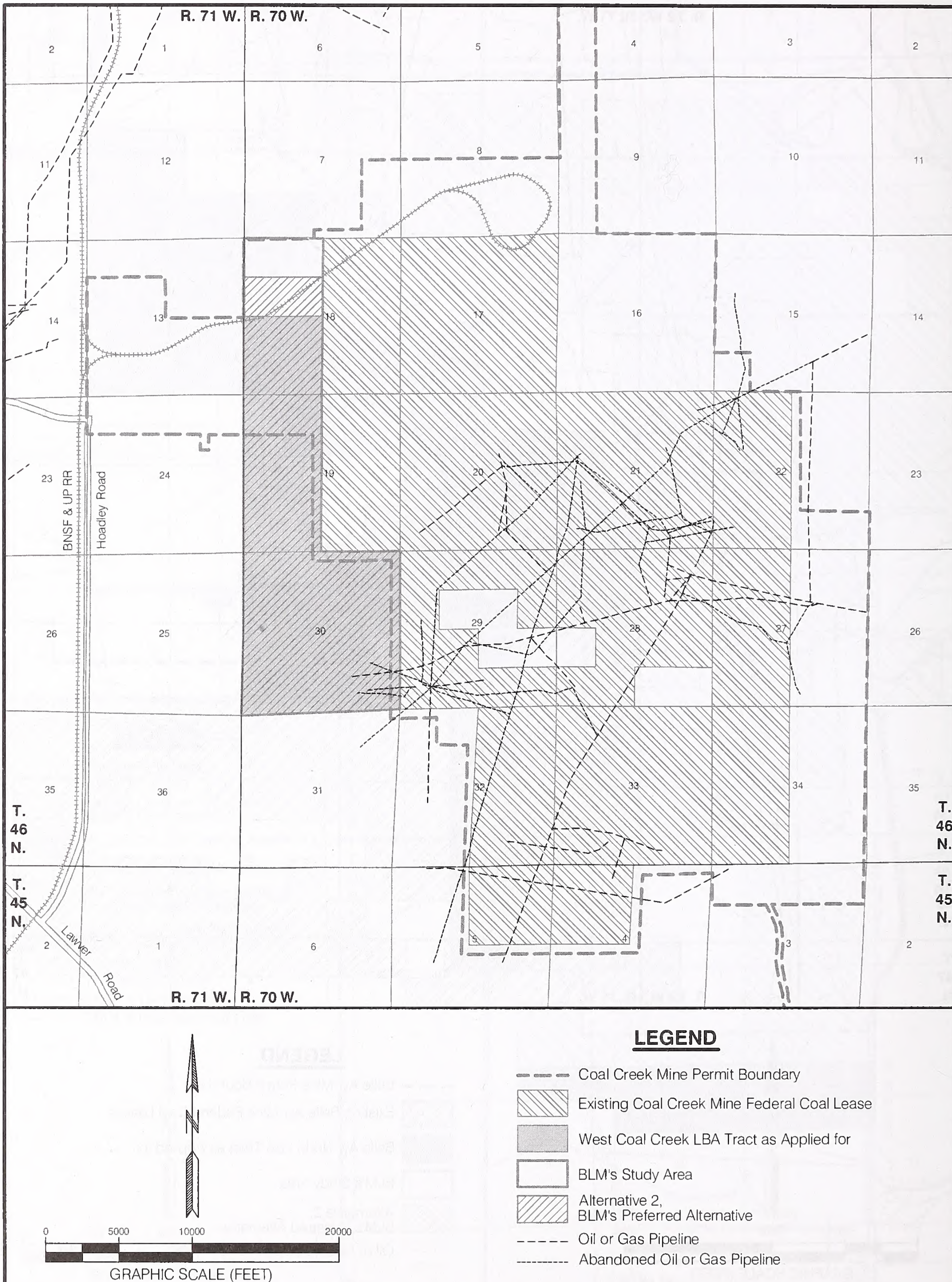


Figure 3-46. Oil and Gas Pipelines Within and Adjacent to the West Coal Creek LBA Tract.

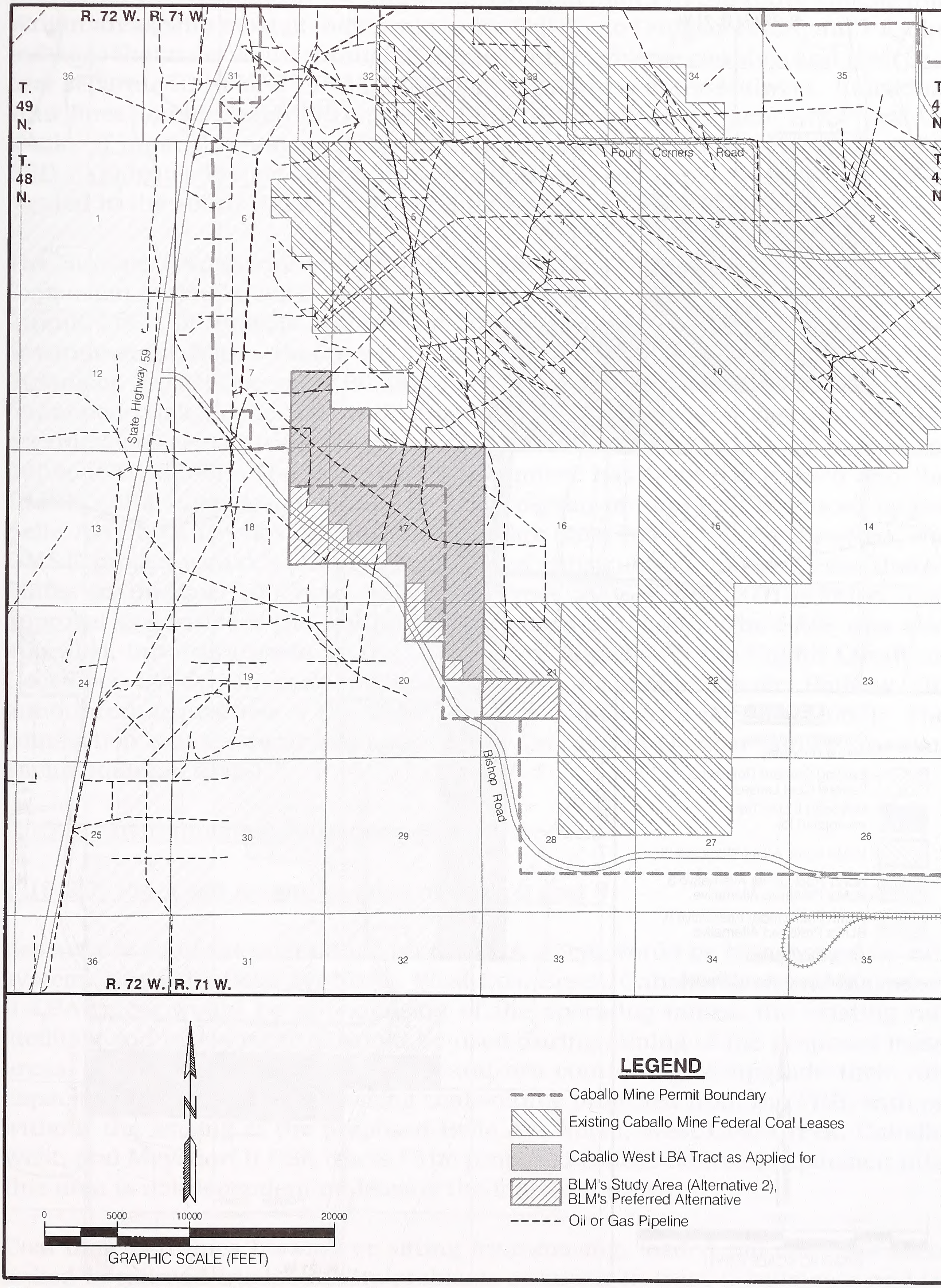


Figure 3-47. Oil and Gas Pipelines Within and Adjacent to the Caballo West LBA Tract.

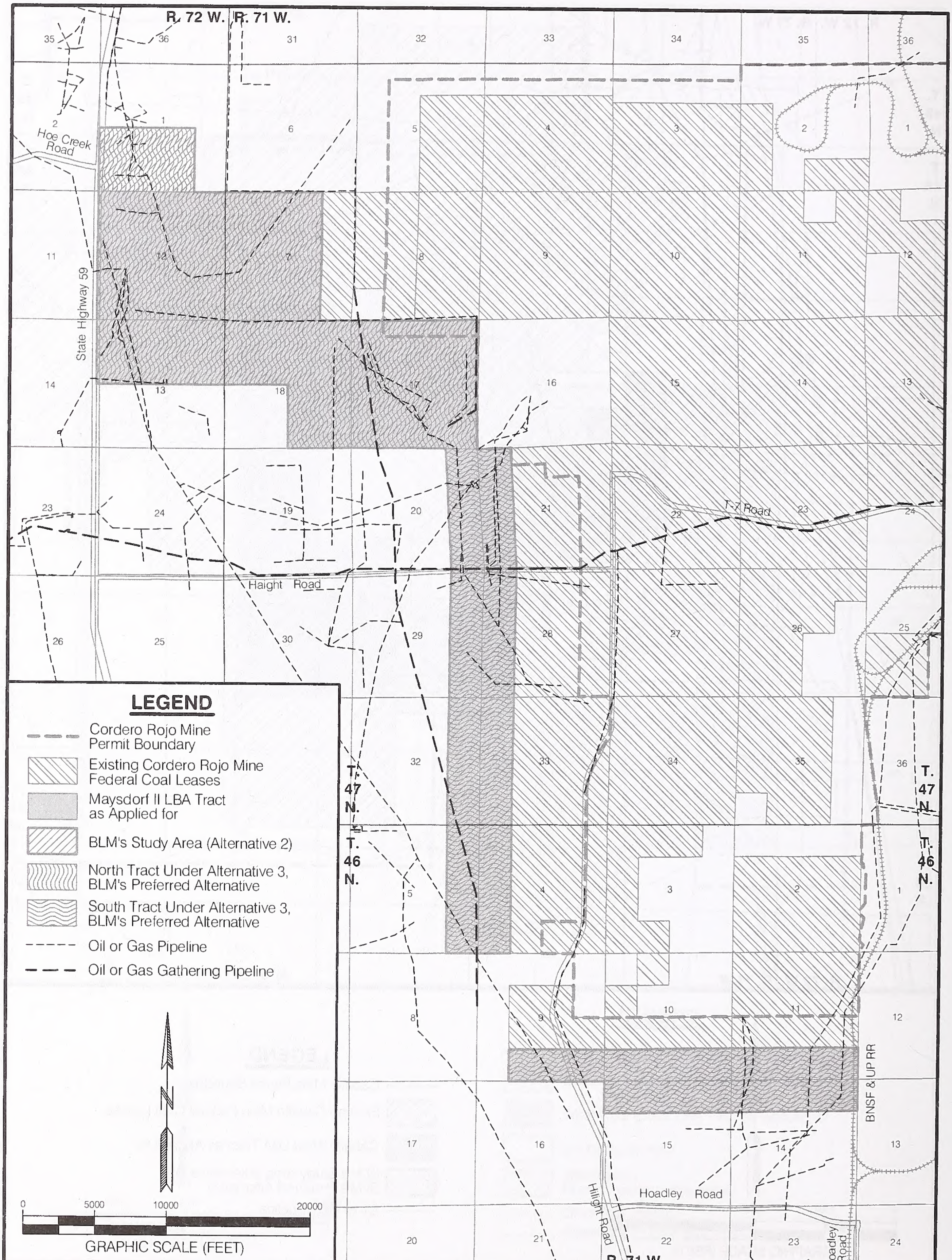


Figure 3-48. Oil and Gas Pipelines Within and Adjacent to the Maysdorf II LBA Tract.

Gillette for destinations in the Midwest. The coal mines in the south Gillette and Wright areas ship most of their coal via the Gillette to Douglas BNSF and UP joint trackage that runs south through Campbell and Converse counties and then east over separate BNSF and UP mainlines for destinations in the Midwest. Individual spur lines connect each PRB mine to the BNSF track or the joint BNSF and UP track. If built, the proposed Dakota, Minnesota and Eastern (DM&E) Railroad PRB Expansion Project would provide additional rail capacity for those mines located in the south Gillette and Wright areas.

The Surface Transportation Board (STB) gave final approval to the DM&E PRB Expansion Project in 2002. However, in response to a successful appeal, the 8th Circuit Court of Appeals directed the STB to give further consideration to four environmental issues that were raised. The STB issued a Final SEIS on the expansion project December 30, 2005, which addressed the four issues that were remanded back to the STB with input from various Federal agencies, Tribes, organizations, environmental groups, businesses, and members of the general public (STB 2006). The issue-driven alignment has been determined and the DM&E rail line would potentially be in a position to haul coal produced by the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines. If constructed, the DM&E project would be the largest railroad construction project in the United States in the last 100 years (Sheridan Press 2006). The STB granted final approval to construct the rail line on February 15, 2006. The SEIS was also appealed, but was upheld by the US Court of Appeals for the Eighth Circuit in December 2006. In early September, 2007, Canadian Pacific Railway Ltd announced acquisition of the DM&E and its subsidiaries (MSNBC 2007). The transaction was reviewed and approved by the STB in October 2008 (Canadian Pacific Railroad 2008).

3.15.2 Environmental Consequences

3.15.2.1 Proposed Action and Alternatives 2 and 3

Essentially all of the coal mined on the LBA tracts would be transported by rail system. Since the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts would be an extension of the operating mines, the existing rail facilities and infrastructure would be used during mining of the proposed lease areas. BNSF & UP have upgraded and are continuing to upgrade their rail capacities to handle the increasing coal volume projected from the PRB, with or without the leasing of the proposed Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts. The proposed DM&E Railroad expansion into this area is not dependent on leasing the four LBA tracts.

Coal dust and fines blowing or sifting from moving, loaded rail cars has been linked to railroad track stability problems resulting in train derailments and to rangeland fires caused by spontaneous combustion of accumulated coal dust. The leasing and mining of the four LBA tracts would not increase the rate of

buildup of coal dust and fines but would prolong the issue. A collaborative effort between the National Coal Transportation Association, the mines, and the BNSF and UP Railroads resulted in an improved design for a coal loading chute that distributes coal more evenly and produces a lower profile load (UPRR 2006). Preliminary results have demonstrated that the new design has resulted in a 30 to 60 percent reduction in coal dust blowing off the top of cars during the early portion of the route. The collaborative team is also analyzing the value of crushing the coal to a 3-inch diameter rather than 2-inch diameter to reduce dust and fines filtering through the bottom gates of rail cars, and using a surfactant applied to the top of the load to reduce coal dust emissions (UPRR 2006).

Active pipelines and utility/power transmission lines currently cross the LBA tracts. Any relocation of these pipelines and utility lines would be handled according to specific agreements between the coal lessee and the pipeline and utility owners, if the need arises. There would be additional surface disturbance associated with construction when pipeline is relocated.

As discussed in chapters 1 and 2, not all of the coal included in the LBA tracts is mineable. Coal included in the Belle Ayr North LBA tract and the Maysdorf II LBA tract under both the Proposed Action and other action alternatives and coal included in the Caballo West LBA tract under Alternative 2 is overlain by portions of existing county roads. In addition, some of the coal included in the tract under the Maysdorf II Proposed Action and Alternatives 2 and 3 is overlain by State Highway 59. SMCRA prohibits mining within 100 ft of the outside right-of-way line of any public road unless the appropriate public road authority allows the road to be relocated or closed after public notice, an opportunity for a public hearing, and a finding that the interests of the affected public and landowners will be protected [30 CFR 761.11(d)]. As a result, the coal underlying the highway and county road rights-of-way and adjacent buffer zones has been determined to be unsuitable for mining according to coal leasing Unsuitability Criterion Number 3 [43 CFR 3461(c)].

The coal underlying the Bishop, Haight, and Hilight Roads and Highway 59 is included in the Belle Ayr, Caballo West, and Maysdorf II LBA tracts being considered for leasing because the coal under the roads could be mined if the authorized public road authorities determine that the roads could be moved [see 43 CFR 3461.5(c)(2)(iii) and discussion in section 2.1]. If the roads are not moved, including the underlying coal in the leases would allow maximum recovery of all the mineable coal adjacent to the road rights-of-way and buffer zones (100 ft on either side of a road right-of-way). FCW and CCC are evaluating the feasibility of relocating the Bishop Road at this time. CMC does not currently have plans to relocate Highway 59 but is evaluating the feasibility of relocating the Haight and Hilight roads.

All mining related road relocation option plans would be reviewed and approved by the Campbell County Commissioners and/or the WYDOT prior to road relocation,

with or without leasing of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts. Vehicular traffic to and from the mines would continue at existing levels for over 10 additional years, depending on the LBA tracts involved and which alternatives are selected.

3.15.2.2 No Action Alternative

Under the No Action alternative, coal removal would not occur on the additional acres that would be disturbed under the Proposed Action or other action alternatives for each tract and the transportation resources located in those areas would not be affected by mining. Currently approved mining operations and any associated impacts to transportation resources would continue on the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine leases. Impacts related to mining operations at these mines would not be extended onto portions of the LBA tracts that will not be affected under the current mining and reclamation plan.

As discussed in chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.15.3 Regulatory Compliance, Mitigation and Monitoring

The regulatory requirements regarding transportation facilities require that no public road be relocated unless the appropriate public road authority allows the road to be relocated or closed and that existing pipelines and utility lines be relocated, if necessary, in accordance with specific agreements between the coal lessee and the pipeline and utility owners.

3.15.4 Residual Impacts

3.15.4.1 Coal Loss During Transport

According to the Federal Railroad Administration (FRA), with the opening of the Powder River Basin in Wyoming in the late 1970s, U.S. coal shipments have grown dramatically from 4.8 million carloads to 8.4 million carloads in 2006, as the railroads deliver low sulfur coal to help electric utilities achieve Clean Air Standards (FRA 2008). The largest rail coal movements are from the Powder River Basin to generating power plants in Illinois, Missouri, and Texas (FRA 2008).

Sifting and blowing coal dust and coal chunks coming off freshly loaded moving railroad cars can accumulate along railroad tracks, railroad rights-of-way, and on adjacent lands. Coal dust can wash into drainages where large deposits of lost coal can accumulate. Accumulated coal dust has been linked to train derailments and can also spontaneously combust and cause wildfires.

Coal can be lost from rail cars through leakage from the rail car discharge doors, spillage over the rail car sides, and can be blown from rail car tops during transit. In testing conducted by Union Pacific Railroad, Burlington Northern Sante Fe Railroad, and the National Coal Transportation Association (NCTA), the average loss of coal from an individual rail car's rapid discharge doors was about 19 pounds per 216 miles, or 0.09 pounds per mile (NCTA 2007). The same testing indicated that an average of 225 pounds of coal was lost from the top of a coal car through either top spillage or being blown off during a 567 mile test trip, which equated to about 0.40 pounds per mile (NCTA 2007).

The derailment of two trains in the PRB in 2005 suspected to have resulted from track instability problems caused by a buildup of coal dust and other particles on the rail bed in combination with high concentrations of moisture (UPRR 2005). BNSF railway officials toured the PRB rail infrastructure in June, 2007. According to a BNSF official, when coal dust is blown off rail cars, it gets lodged in the rail bed, allowing moisture to intrude. The moisture then degrades the structural stability of the rail bed and leaves the rail more vulnerable to buckling under stress (Gillette News-Record 2007a). NCTA (2007) testing results suggested that rail car bottom spillage may have more of a negative impact on rail ballast stability than loss from the top of rail cars since the leakage is directly above and near the ballast. NCTA (2007) testing also showed that after the rapid discharge doors were adjusted, there was a 32 percent decrease in bottom spillage of coal.

Accumulating coal dust and deposition has become a concern in Converse County. The majority of coal mined in the PRB travels through Converse County on railroads. Coal dust blows off the freshly loaded coal cars on their way from the PRB mine load-outs to Bill and through Converse County (Casper Star Tribune 2007a).

Spontaneous combustion of accumulated coal dust can cause rangeland fires. Smoldering coal dust within a railroad right-of-way can ignite a wildfire and quickly spread to surrounding private lands if the fire is not immediately controlled. The Douglas Volunteer Fire Department Chief, Rick Andrews, estimates that coal fires account for at least 50 percent of the department's average summer call volume (Casper Star Tribune 2007a). Coal fires along the railroad tracks are an ongoing problem for the Douglas Volunteer Fire Department (Casper Star Tribune 2007a). Often water only temporarily puts down the flames; some fires repeatedly ignite over the course of several hours or days (Casper Star Tribune 2007a). While the county's rural fire district is compensated for some of the costs involved in putting out fires caused by transported coal, the compensation doesn't come close to the actual costs, according to the Douglas Volunteer Fire Department Chief (Casper Star Tribune 2007a).

BLM was invited by a Converse county private land owner to examine and survey the coal deposition that has occurred from coal trains traveling through his land. On July 7, 2008, BLM personnel met with the private landowner and toured his

rangeland that was adjacent to the railroad right-of-way, about 26 miles north of Douglas, Wyoming. BLM surveyed various coal accumulations in Box Creek; one area was found to have a coal accumulation of 1.8 feet thick (BLM 2008d). Water runoff washed coal lost from the trains into drainages, with the amount of coal deposition varying along the tracks (BLM 2008d).

BNSF is working with the utility companies and the mines in trying to encourage a larger diameter of crushed coal to be delivered (3-inch versus 2-inch) in an effort to reduce the amount of small particles that are created in the crushing process (UPRR 2006). Another possibility that may help lessen blowing coal dust from trains is the use of surfactants applied to the tops of loaded coal cars (Gillette News-Record 2007a). When applied to coal, surfactants can adhere coal dust to larger coal chunks. Some tests have shown that coal dust on railroad tracks can be reduced by up to 95 percent with surfactant use (Gillette News-Record 2007a). Surfactant application requires large amounts of water and they would need to meet utility companies' burning specifications in order to be used (Burget 2008 and Gillette News-Record 2007a).

A collaborative effort between the NCTA, PRB mines, and the BNSF and UP railroads has resulted in an improved design for a coal loading chute that distributes coal more evenly and produces a lower profile load (UPRR 2006). Preliminary results have demonstrated that this new design may result in a 30 to 60 percent reduction in coal dust blowing off the top of cars during the early portion of the route (UPRR 2006).

Converse County Commissioners have formally expressed concerns to BLM in regard to fire, health, and safety issues associated with blowing coal dust from trains. The Commissioners have stated that the health and well-being of Converse County citizens downwind of the railroad tracks continue to be jeopardized due to lack of coal dust mitigation in the coal mining permit process (BLM 2008e). The Converse County Commissioners have urged that coal dust mitigation be applied as a standard condition of approval upfront in the mining permit (BLM 2008e).

BLM does not authorize mining permits nor regulate mining operations with the issuance of a BLM coal lease. In Wyoming, WDEQ has entered into a cooperative agreement with the Secretary of the Interior to enforce mining regulations and regulate surface coal mining operations. Any action related to the mining of leased coal must be approved by WDEQ before mining operations can occur on the leased federal coal lands. Mitigation and other requirements are developed as part of the mining and reclamation permit.

Other agencies that may be stakeholders in this issue include the Federal Railroad Administration, which implements U.S. Department of Transportation environmental policies related to U.S. railroads, and the National Coal Transportation Association whose mission includes facilitating the resolution of

coal transportation issues in order to serve the needs of the general public and industry (NCTA 2008).

3.16 Hazardous and Solid Waste

3.16.1 Affected Environment

Potential sources of hazardous or solid waste on the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts would include spilled, leaked or dumped hazardous substances, petroleum products, and/or solid waste associated with coal and oil and gas exploration, oil and gas development, the BNSF & UP railroad, utility line installation and maintenance, or agricultural activities. No such hazardous or solid wastes are known to be present on any of the four LBA tracts. Wastes produced by current mining activities at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines are handled according to the procedures described in chapter 2, section 2.8.

3.16.2 Environmental Consequences

3.16.2.1 Proposed Action and Alternatives 2 and 3

If the applicant mines acquire the four LBA tracts, the wastes that would be generated in the course of mining the tract would be similar to those currently being generated by the existing mining operation. The procedures that are used for handling hazardous and solid wastes at the existing mines are described in chapter 2, section 2.8. Wastes generated by mining the LBA tracts would be handled in accordance with the existing regulations using the procedures currently in use and in accordance with WDEQ-approved waste disposal plans at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines.

3.16.2.2 No Action Alternative

Under the No Action alternative, coal removal would not occur on the additional acres that would be disturbed under the Proposed Action or other action alternatives for each tract and no waste materials would be generated as a result of coal removal on the tracts. Coal removal and any associated waste production would continue on the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine leases. Impacts related to mining operations at this mine would not be extended onto portions of the LBA tracts that will not be affected under the current mining and reclamation plans, and no waste materials would be generated as a result of coal removal on the tracts.

As discussed in chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.16.3 Regulatory Compliance, Mitigation and Monitoring

The regulatory requirements regarding production, use, and/or disposal of hazardous or extremely hazardous materials are discussed in chapter 2. All mining activities involving the hazardous materials are and would continue to be conducted so as to minimize potential environmental impacts.

3.16.4 Residual Impacts

No residual hazardous and solid waste impacts are expected.

3.17 Socioeconomics

The social and economic study area for the proposed project includes Campbell County and the City of Gillette. The community of Gillette, the county seat, would most likely attract the majority of any new residents due to its current population levels and the availability of services, shopping amenities, and educational institutions.

3.17.1 Local Economy

3.17.1.1 Affected Environment

Wyoming's coal mines produced 452.1 million tons in 2007, according to the Wyoming State Inspector of mines. This was an increase of almost 2 percent over the 444.9 million tons produced in 2006. PRB coal production (Campbell and Converse counties, 14 active mines) was over 436.6 million tons in 2007, which represented almost 97 percent of the state coal production (Wyoming Department of Employment 2006 and 2007a).

Approximately 27 percent of the November of 2007 total employment in Campbell County and 40 percent of the second quarter 2007 total payroll was attributed to the natural resources and mining sector (Wyoming Department of Employment 2007b and Wyoming Department of Employment 2008a). In 2007, Campbell County employment grew at a similar rate compared to the statewide average (3.7 percent versus 3.6 percent change, respectively). Job growth occurred in construction, trade, manufacturing, transportation and utilities, and local government, but the most dramatic increase was in the manufacturing sector (Wyoming Department of Employment 2008b).

Revenues to the federal government from the leasing and production of federal coal include retention of one-half of the lease bonus bids and federal mineral royalties. Lease bonus bids are paid to the federal government for the right to enter into lease agreements for federal coal. Bonus bids are paid in five annual installments; the state receives half of each installment. In 2004 and 2005, BLM held competitive sealed-bid lease sales for six federal coal tracts in the PRB (NARO

South, West Antelope, West Hay Creek, Little Thunder, West Roundup, and NARO North). No coal lease sales were held for federal coal tracts in the PRB in 2006 or 2007. Two lease sales (Eagle Butte West and South Maysdorf) were held in 2008 and one sale (North Maysdorf) has been held thus far in 2009.

The successful bonus bids for the six lease sales held in 2004 and 2005 ranged from 30 cents per ton to 97 cents per ton and totaled $1.69 billion (BLM 2006b). Annual bonus bid payments from the six lease sales total $338.2 million. Combined with remaining bonus bid payments from lease sales held in previous years of $90.1 million, the annual bonus bid payment total for 2004 was $428.3 million, derived directly from federal coal in Campbell and Converse counties. The Wyoming Consensus Revenue Estimating Group is projecting that coal lease bonus revenues to the state will be $169.8 million for fiscal years 2007, 2008, and 2009. The bonus money received by the state is allocated to fund capital construction for cities and towns, the state's highway fund, community colleges, and school capital construction (Wyoming CREG 2007).

Wyoming, Campbell County, and the cities and towns in the county receive revenue from a variety of taxes and royalties on the production of federal coal in addition to the bonus bids. These include ad valorem taxes, severance taxes, royalty payments, sales and use taxes, and required contributions to the Abandoned Mine Land (AML) program and the Black Lung Disability Trust Fund.

Federal mineral royalties are collected at the time the coal is sold and equal 12.5 percent of the sale price. In the past, federal royalties and bonus bids had been divided equally with the state of Wyoming. However, for fiscal years 2008 and 2009, Congress decreased the state's royalty share to 48 percent, and increased the federal government's share to 52 percent. The percentage of federal bonus, rental, and royalty payments distribution will revert back to 50 percent/50 percent at the end of the 2009 fiscal year unless legislation is passed in the future to maintain or further modify the current percentage of distribution of royalties. Coal mines pay 31.5 cents per ton of surface coal mined to fund AML reclamation programs. Annual appropriations returned to the states vary depending on Congressional authorizations and AML program priorities. Additional sources of revenue include federal income tax and annual rentals that are paid to the government.

Sales and use taxes, which are levied by the state and local governments, are distributed to cities and towns within the county and to the county's general fund. Approximately 70 percent of the revenues generated from the statewide 4.0 percent levy are retained by the state, the remainder being distributed to the counties, cities and towns according to statutory formula. In addition, the Campbell County government imposes a 1.0 percent general purpose local option tax and a 0.25 percent specific county option tax. Sales and tax revenues are vital for local governments. According to the Excise Tax Division of the Wyoming Department of Revenue (2004), the sales and use taxes collected from coal mines

and coal mining-related services in Campbell County in fiscal year (FY) 2004 was $8.2 million.

Ad valorem taxes comprise production and property taxes, with production taxes being far greater than property taxes for surface coal mines. Ad valorem taxes are collected by the county and disbursed to local governments and school districts that rely heavily on ad valorem taxes. Rising production and market values for oil and gas, and the increases in coal production tonnages have given rise to dramatic increases in the ad valorem tax bases of producing counties, particularly Campbell County. In 2005, Campbell County had an ad valorem tax base of $3.66 billion; more than 22 percent of the aggregate statewide assessed value on all real property and mineral production. The coal mining industry accounted for 59 percent of Campbell County's 2005 total assessed value (Wyoming Department of Revenue 2006 and Wyoming State Board of Equalization 2007).

In 1994, the University of Wyoming estimated that the total fiscal benefit to the state of Wyoming for coal produced in the PRB was $1.10 per ton (Borden et al. 1994). This study did not include AML fees or bonus bid payments in the calculation for fiscal benefits to the state of Wyoming. Calculating the estimated total fiscal benefit to the state of Wyoming in 2005 by including half of the bonus bid payments, half of the federal mineral royalties based on current prices, half of the AML fees, and all of the ad valorem taxes, severance taxes, and sales and use taxes for coal produced in Campbell County in 2005 results in an estimated $661 million, or $1.62 per ton. Figure 3-49 depicts the estimated total revenues to state and federal governments from 2006 coal production in Campbell County.

Recent (2004) Gross State Product (GSP) calculations for Wyoming indicate that the minerals industry (mining and oil and gas) accounted for about 21 percent of the state's total GSP of $24.1 billion, which made it the largest sector of the Wyoming economy. The contribution of mining was nearly twice that of government, the next largest sector, and more than three times the contribution of the real estate industry, the next largest private sector. Mining alone accounted for 8.3 percent of the Wyoming GSP (Wyoming Department of Administration and Information 2007a).

3.17.1.2 Environmental Consequences

3.17.1.2.1 Proposed Action and Alternatives 2 and 3

The federal and state revenues that would be generated by the leasing and mining of the LBA tracts would depend on which alternative is selected and the sale price of the coal. Coal prices increased in 2005, generally as a result of concerns over coal transportation and stockpile issues, but declined in 2006. According to the WSGS, the average spot price of 8,400 Btu coal in the PRB in the second half of 2005 was $11.06 per ton, compared with an average spot price during the first half of 2005 of $7.29 per ton and an average spot price of $4.93 per ton the year

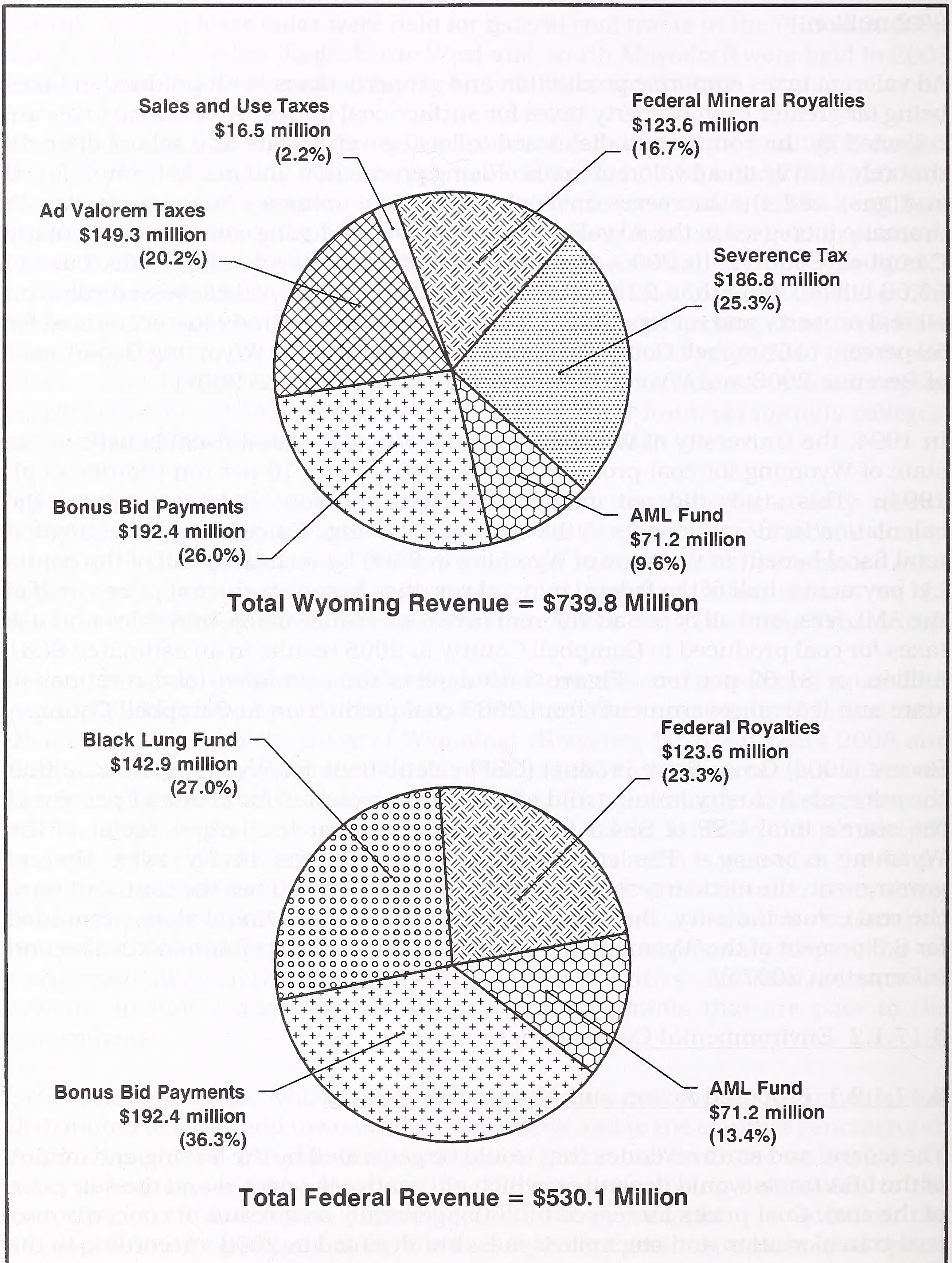


Figure 3-49. Estimated Wyoming and Federal Revenues from 2006 Coal Production in Campbell County.

before (WSGS 2006). However, PRB spot prices declined throughout 2006. The average spot price for 8,400 Btu coal was $9.86 per ton in 2006 (WSGS 2008). The Wyoming Consensus Revenue Estimating Group is forecasting that the average gross sales prices for Wyoming coal production will ranged from $9.98 to $10.65 per ton from 2007 through 2012 (Wyoming CREG 2008). PRB prices are generally lower than prices for coal produced in other areas of Wyoming; however, most of the coal produced in Wyoming is from the PRB. For the purposes of this EIS, a conservative average price of $9.98 per ton (Wyoming CREG 2008) is estimated for the coal included in the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II LBA tracts, which have an average Btu value of a little over 8,400.

Using the coal tonnages shown in tables 3-1 through 3-4, projected federal and state revenues for the LBA tracts are presented in table 3-19, assuming an average coal price of $9.98 per ton recovered and a potential range of bonus payments on the leased (mineable) coal of 30 to 97 cents per ton.

Table 3-19. Projected Socioeconomic Impacts from Leasing the South Gillette Analysis Area LBA Tracts Under the Proposed Action and Alternatives 2 and 3.

Tract and Item	No Action Alternative (Existing Mine)	Proposed Action	Alternatives 2 and 3
Belle Ayr North LBA			
State Revenues	$382.9 million	$276.1 – $331.3 million	$267.7 - $321.1 million
Federal Revenues	$283.6 million	$210.9 – $266.1 million	$204.5 - $258.0 million
Increased Mine Life	0 yrs	6.4 yrs	6.8 yrs
Additional Employees	0	8	8
West Coal Creek LBA			
State Revenues	$353.2 million	$102.1 to $123.3 million	$102.1 to $123.3 million
Federal Revenues	$261.6 million	$78.1 to $99.3 million	$78.1 to $99.3 million
Increased Mine Life	0 yrs	4.3 yrs	4.3 yrs
Additional Employees	0	10	10
Caballo West LBA			
State Revenues	$949.6 million	$146.0 – $175.3 million	$163.6 - $196.5 million
Federal Revenues	$703.4 million	$111.5 - $140.8 million	$125.0 - $157.9 million
Increased Mine Life	0 yrs	2.2 yr	2.6 yr
Additional Employees	0	0	0
Maysdorf II LBA			
State Revenues	$854.0 million	$778.0 – $939.7 million	$822.8 - $993.7 million
Federal Revenues	$632.6 million	$595.1 - $756.7 million	$629.3 - $800.3 million
Increased Mine Life	0 yrs	9.7 yrs	10.3 yrs
Additional Employees	0	60	63

If the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II LBA tracts are leased and mined under the Proposed Actions or other action alternatives potential federal revenues would vary by LBA tract as indicated below.

3.17.1.2.1.1 Belle Ayr North LBA Tract

Under the Proposed Action, the potential additional federal revenues would range from approximately $211 million to $266 million. Under Alternative 2, potential additional federal revenues would range from approximately $205 million to $258 million.

If the LBA tract is leased and mined under the Proposed Action, the potential additional state revenues would range from about $276 million to $331 million. Under Alternative 2, potential additional state revenues would range from about $268 million to $321 million.

The base of economic activity provided by wages and local purchases would continue for over 6 additional years, depending on which alternative is selected.

3.17.1.2.1.2 West Coal Creek LBA Tract

Under the Proposed Action and under Alternative 2, the potential additional federal revenues would range from approximately $78 million to $99 million.

If the LBA tract is leased and mined under the Proposed Action and under Alternative 2, the potential additional state revenues would range from about $102 million to $123 million.

The base of economic activity provided by wages and local purchases would continue for just over 4 additional years.

3.17.1.2.1.3 Caballo West LBA Tract

Under the Proposed Action, the potential additional federal revenues would range from approximately $112 million to $141 million. Under Alternative 2, potential additional federal revenues would range from approximately $125 million to about $158 million.

If the LBA tract is leased and mined under the Proposed Action, the potential additional state revenues would range from about $146 million to $175 million. Under Alternative 2, potential additional state revenues would range from about $164 million to $197 million.

The base of economic activity provided by wages and local purchases would continue for over 2 additional years.

3.17.1.2.1.4 Maysdorf II LBA Tract

Under the Proposed Action, the potential additional federal revenues would range from approximately $595 million to $757 million. Under Alternatives 2 and 3, potential additional federal revenues would range from approximately $629 million to $800 million.

If the LBA tract is leased and mined under the Proposed Action, the potential additional state revenues would range from about $778 million to $940 million. Under Alternatives 2 and 3, potential additional state revenues would range from about $823 million to $994 million.

The base of economic activity provided by wages and local purchases would continue for over 10 additional years, depending on which alternative is selected.

3.17.1.2.2 No Action Alternative

Under the No Action alternative, the potentially recoverable coal included in an LBA tract under the Proposed Action or other action alternatives would not be mined and the economic benefits associated with mining that coal would not be realized by the state or federal government. Currently approved mining operations and associated economic benefits would continue on the existing mine leases. Portions of the LBA tracts adjacent to the existing mines would be disturbed to recover the coal in the existing leases.

As discussed in section 2.2, a decision to reject the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease a tract in the future.

3.17.2 Population

3.17.2.1 Affected Environment

Campbell County's population rose from 33,698 in 2000 to an estimated 40,433 in July 2007. This represents a 20 percent growth since 2000 and makes Campbell County the second fastest growing county in the state (following only Sublette County, which ranked fifth in growth in the nation between July 2006 and July 2007). Campbell County's population ranks it as the third most populous of Wyoming's 23 counties (U.S. Census Bureau 2007).

The majority of the four applicant mines' employees and support services reside in Gillette and Wright. It is estimated that the total population in the City Limits of Gillette increased from 24,235 at the beginning of 2003 to 30,636 at the end of 2007; an increase of 26.4 percent over five years. Gillette accounts for roughly 62 percent of the county's residents (City of Gillette 2008a). Wright's population rose from 1,355 in July 2000 to an estimated 1,529 in July 2007, accounting for about

4 percent of the county's residents (U.S. Census Bureau 2007). Gillette is currently the fourth largest city in the state, following Cheyenne, Casper, and Laramie. (Wyoming Department of Administration and Information 2007a).

3.17.2.2 Environmental Consequences

3.17.2.2.1 Proposed Action and Alternatives 2 and 3

As indicated by table 3-19, leasing and subsequently mining the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II LBA tracts would extend the life of the existing mines and current employment at the mines by nearly 10 additional years, depending on which LBA tract and which alternative is selected. Average yearly employment at the mines would increase by up to 63 positions under the Proposed Action and other action alternatives (Cordero Rojo Mine - table 3-19). It is likely that the additional employees would be available from the existing workforce in Campbell County and no influx of new residents would occur as a result of filling these new positions.

3.17.2.2.2 No Action Alternative

Under the No Action alternative, the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II coal lease applications would be rejected and the coal included in an LBA tract under the Proposed Action or other action alternatives would not be mined. Population levels would not be affected by any additional employment at the existing mines. Currently approved mining operations and associated employment levels would continue on the existing mines leases for from about 6 years at the Cordero Rojo Mine up to approximately 17 years at the Coal Creek Mine.

As discussed in section 2.2, a decision to reject the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease a tract in the future.

3.17.3 Employment

3.17.3.1 Affected Environment

The statewide total employment increased by more than 10 percent from 2003 to 2006, and nearly one-of-three of the new jobs created during that 3-year period was in the mining industry. During the same period, statewide coal mining employment increased by 762 jobs, a 16 percent increase. From 2003 to 2006, total employment in Campbell County grew by 3,384 jobs, a 16 percent increase. From 2000 through November 2007, the number of employees in Campbell County grew by about 33 percent (19,299 to 25,762) (City of Gillette 2008a). The average unemployment rate in Campbell County for 2006 was 2.1 percent and less than 2.0 percent for 2007 (City of Gillette 2008a), even as the local labor force

has grown due to immigration and attraction of additional residents into the labor force (U.S. Bureau of Labor Statistics 2008).

Surface coal mining has changed substantially in recent times, largely as a result of new technologies and higher capacity equipment. The local coal mining labor force grew rapidly during the 1970s as more mines opened and production increased. Between 1980 and 1998, overall production rose while employee numbers generally decreased or remained constant. The employment declines followed large industry capital investments in facilities and production equipment, the majority of which were aimed at increasing productivity (BLM 2005c). Since 1998, direct employment in the PRB coal mines climbed as total annual production increased by more than 45 percent (Wyoming Department of Employment 1998 and 2007a).

The mining sector, which includes oil and gas workers, accounts for nearly 28 percent of all employment in Campbell County, nearly four times the statewide percentage. In the fourth quarter of 2007, around 7,267 people were directly employed by surface coal mines or coal contractors in Campbell County, representing about 26 percent of the Campbell County employed labor force (Wyoming Department of Employment 2008a). Campbell County also has slightly higher percentages of construction and wholesale trade employment, which is keeping with the development demands of continuing growth and the county's position as a commercial center for northeast Wyoming.

3.17.3.2 Environmental Consequences

In January 2008, the unemployment rate in Campbell County was 2.5 percent (664 unemployed persons out of a total labor force of 26,295) (Wyoming Department of Employment 2008b). It is likely that additional employees would be available from the existing labor force in Campbell County, depending on the timing of the hiring at the mines as compared to the timing of hiring for other ongoing and proposed projects in the county, which are discussed in section 4.1.

3.17.3.2.1 Proposed Action and Alternatives 2 and 3

3.17.3.2.1.1 Belle Ayr North LBA Tract

Leasing and subsequently mining the Belle Ayr North LBA tract would extend the life of the Belle Ayr Mine by up to nearly 7 additional years, depending on which alternative is selected. As discussed above, average yearly employment at the mine would not increase under the Proposed Action and Alternative 2 (table 3-19). The economic stability of the community of Gillette would benefit by having the current Belle Ayr Mine workforce living in the community and employed at the mine for up to about 7 additional years.

3.17.3.2.1.2 West Coal Creek LBA Tract

Leasing and subsequently mining the West Coal Creek LBA tract would extend the life of the Coal Creek Mine by about 4 additional years, regardless of which alternative is selected. As discussed above, average yearly employment at the mine would not increase under the Proposed Action and Alternative 2 (table 3-19). The economic stability of the community of Gillette would benefit by having the current Coal Creek Mine workforce living in the community and employed at the mine for up to about 4 additional years.

3.17.3.2.1.3 Caballo West LBA Tract

Leasing and subsequently mining the Caballo West LBA tract would extend the life of the Caballo Mine by up to over 2 additional years, regardless of which alternative is selected. As discussed above, average yearly employment at the mine would not increase under the Proposed Action and Alternative 2 (table 3-19). The economic stability of the community of Gillette would benefit by having the current Caballo Mine workforce living in the community and employed at the mine for over 2 additional years.

3.17.3.2.1.4 Maysdorf II LBA Tract

Leasing and subsequently mining the Maysdorf II LBA tract would extend the life of the Cordero Rojo Mine by up to about 10 additional years, regardless of which alternative is selected. As discussed above, average yearly employment at the mine would increase by up to 63 positions under the Proposed Action and Alternative 2, Alternative 3 (North Tract) and Alternative 3 (South Tract) (table 3-19). The economic stability of the community of Gillette would benefit by having the current Cordero Rojo Mine workforce living in the community and employed at the mine for up to about 10 additional years.

3.17.3.2.2 No Action Alternative

Under the No Action alternative, the LBA tract lease applications would be rejected and the coal included in an LBA tract under the Proposed Action or other action alternatives would not be mined. Mine life and existing employment levels would not be extended for nearly 10 additional years, and any increase in employees associated with mining the coal in the tract would not occur. Currently approved mining operations and associated employment would continue on the existing mines leases for from about 6 years at the Cordero Rojo Mine to approximately 16 years at the Coal Creek Mine. Direct jobs provided by the mines and those supported indirectly by those operations and the consumer expenditures of the mines' workforces would be lost sooner than if leasing were to occur.

As discussed in section 2.2, a decision to reject the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease a tract in the future.

3.17.4 Housing

3.17.4.1 Affected Environment

According to a 2001 report on housing needs in Campbell County, roughly 61 percent of PRB surface coal mining employees live in Gillette and surrounding areas, 14 percent live in Wright, and 25 percent live outside of Campbell County (Pederson Planning Consultants 2001).

There were 11,538 housing units in Campbell County reported in the 1990 census. The 2000 census counted 13,288 housing units in Campbell County, of which 12,207 were occupied at the time. There were 8,989 (73.6 percent) owner occupied units and 3,218 (26.4 percent) occupied rental units (U.S. Census Bureau 2000).

The number of housing units in Gillette increased from 7,078 in 1990 to 7,931 in 2000, an increase of 12 percent. The number of housing units increased in Wright from 528 in 1990 to 544 in 2000, an increase of slightly over 3 percent. The types of housing units counted in 2000 included 6,698 single-family detached units, 794 single-family attached units, 2,276 multi-family units, 3,432 mobile homes, and 88 RVs, vans, or similar types of units. Subsequent construction added 561 single-family detached, 61 single-family attached, 498 manufactured homes, and 352 multi-family units in Gillette and Wright, plus an unknown number of single-family and manufactured units in rural areas. The resulting totals are estimated at 7,259 single-family detached units (49.2 percent), 855 single-family attached units (5.8 percent), 2,628 multi-family units (17.8 percent), 3,930 mobile/manufactured units (26.6 percent), and 88 RV/vans (0.6 percent) (CSI 2005).

Population growth since 2000 has prompted new housing construction in the region. In Campbell County, net additions to the number of housing units from 2000 through 2005 total 797. Construction has not kept pace with demand. As a consequence, vacancy rates are near record lows and housing prices have climbed. In the second half of 2006, vacancy rates of rental units were 0.4 percent (6 units) in Campbell County (WCDA 2007). During 2006, there were 631 housing units permitted; a new record. During 2007, another new record was established at 1,112 housing units permitted. The housing inventory in Gillette increased from 10,194 units to 11,347 units over the 2007 calendar year; an increase of 11.3 percent (City of Gillette 2008a). The number of units added in unincorporated, rural areas of Campbell County is not known because the county does not require building permits or certificates of occupancy for residential development in unincorporated areas (Braunlin 2004).

A survey conducted in October 2004 estimated the vacancy rate of rental units to be 7.0 percent, based on a sample of approximately 40 percent of all rental units, mostly in larger complexes (CSI 2005). According to a 2006 housing survey, there was a 0.10 percent vacancy rate for rental property in 2007, while the average annual vacancy rate for manufactured home/mobile home rentals within the city limits was 5.2 percent (City of Gillette 2008a). Many apartments had long waiting lists.

In the second quarter of 2007, average housing rental costs in Campbell County were $691 for a two-bedroom, unfurnished apartment, $292 for a single-wide mobile home lot, and $1,127 for a two or three-bedroom single family home (Wyoming Department of Administration and Information 2007b). In the second quarter of 2008, average housing rental costs in Campbell County were $717 (a 3.8 percent increase) for a two-bedroom, unfurnished apartment, $318 (a 9.1 percent increase) for a single-wide mobile home lot, and $1,314 (a 16.7 percent increase) for a two or three-bedroom single family home (Wyoming Department of Administration and Information 2008).

The average selling price of homes in Campbell County, based on 528 sales, in 2007 was $247,150. That average represents a 23.6 percent increase over that in 2006 and sixth highest among Wyoming counties (WCDA 2008).

In addition to permanent housing, temporary or transient housing is a consideration for any project that might have a construction component. Temporary housing can include hotels or motels, campgrounds, and possibly mobile home parks. Given the tight housing market in Gillette, some such units are reportedly being used for longer-term occupancy by workers and families waiting for traditional housing to become available (Langston 2005).

There are 17 motels in Gillette with 1,346 guest rooms, one additional 27-room motel in Wright and a two-room bed & breakfast in Gillette. Hotel occupancy rates have recently been very high and several new hotels are proposed for construction (Gillette News-Record 2006). Gillette has two year-round commercial campgrounds with 150 hookups for RVs plus tent areas (Gillette Convention and Visitor's Bureau 2004). Campbell County has a multi-event facility, the CAM-PLEX, located in Gillette. It has 1,821 RV sites, which vary from 688 full service sites with rest rooms and shower facilities to electric only sites. The CAM-PLEX facilities are generally available only for scheduled special events, not for public camping (CAM-PLEX 2005).

Gillette also has approximately 1,595 mobile home park spaces. Mobile home parks are generally considered permanent housing resources, but they sometimes provide temporary spaces for RVs as well if there are vacant spaces available. As of early October 2004, the average vacancy rate in Gillette's mobile home parks was 35 percent, or 558 spaces (CSI 2005).

3.17.4.2 Environmental Consequences

3.17.4.2.1 Proposed Action and Alternatives 2 and 3

As discussed above, average yearly employment at the mines would increase by up to 63 positions (Cordero Rojo Mine) and employment at the mines would be extended by up to approximately 10 additional years, under the Proposed Actions and other action alternatives. No additional demands on the existing infrastructure or services in the community would be expected because little or no influx of new residents would be needed to fill new jobs. Although housing is tight in Gillette, it is likely that housing for the additional employees would be available from the existing and proposed units in Campbell County.

3.17.4.2.2 No Action Alternative

Under the No Action alternative, the coal lease applications would be rejected and the coal included in an LBA tract under the Proposed Action or other action alternatives would not be mined. Housing occupancy would not be affected by any additional employment at the mines. Currently approved mining operations and associated employment levels would continue on the existing mines leases for from about 6 years at the Cordero Rojo Mine to approximately 17 years at the Coal Creek Mine. When the existing leases are mined out, mining operations would cease likely triggering population out-migration from the area and adversely affecting housing markets.

As discussed in section 2.2, a decision to reject the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease a tract in the future.

3.17.5 Local Government Facilities and Services

3.17.5.1 Affected Environment

The availability of revenues generated by mineral production has helped local government facilities and services keep pace with growth. Current facilities and services are generally adequate for the current population, although several service providers are engaged in expansion plans to accommodate future growth.

Campbell County School District No. 1's enrollment as of December 2007 is listed as stable at 7,569 students, making it the third largest school district in Wyoming. The district facilities include: one high school (with two campuses) and two junior high schools in Gillette, a junior-senior high school in Wright and 15 elementary schools (including one in Wright and three in rural areas). The district also operates an alternative high school and aquatic center in Gillette (CCSD 2007). The Campbell County School District is involved in a major five-year plan to replace several schools, modernize others and complete major systems

maintenance and upgrades. The School District initiated a Capital Facilities Plan during 2007, and there are three new elementary schools under review at this time (City of Gillette 2008a).

Law enforcement services throughout the county are provided by the Campbell County Sheriff's Office, while the Gillette Police Department provides police protection within the City of Gillette. In addition to general law enforcement, the Sheriff's staff and city police officers provide court security, detention facilities, and animal control. The Campbell County Detention Center is a 24-hour supervised, 128-bed facility that includes separate modules for women and juveniles (BLM 2005c).

Fire suppression throughout Campbell County is provided by the Campbell County Fire Department, which is governed by a city-county joint powers board. The department maintains four stations in Gillette and six dispersed throughout the county. The department has 17 full-time staff and 150 trained volunteers. In addition, there are 30 to 40 volunteers in outlying areas who are trained and equipped primarily to fight wildland fires. Campbell County coal mines generally provide equipment and trained staff to fight fires on mine property, and if called upon, the County Fire Department provides backup assistance with personnel and equipment (Vonsik 2005).

The primary medical care facility in Campbell County is Campbell County Memorial Hospital, a 90-bed acute care hospital, located in Gillette. The hospital has a medical staff of over 50 affiliated physicians in 20 specialties and a total staff of 800 (CCMH 2005). The hospital also operates the Wright Clinic, a satellite clinic with a full-time, family practice physician. Ambulance service for Campbell County is provided by the hospital, which has a 24-hour emergency service capability. The Campbell County Fire Department provides first responder service to emergency calls, but transport is the responsibility of the hospital affiliated ambulance service.

Water and wastewater treatment systems are provided by the City of Gillette. Gillette's water supply, which is a system of groundwater wells, has the capacity to serve approximately 30,600 people within the city limits and some nearby urbanized areas. Water use approaches capacity during the peak demand months in the summer when parks and private lawns are being irrigated (Morovits 2005). The City of Gillette and Campbell County have developed a long term water supply plan called the Gillette Regional Water Supply Project that includes an additional Madison Formation well field and pipeline with a capacity to serve approximately 50,000 people (City of Gillette 2008b). Projected completion is about six years. In the interim, the city has other wells it can pump if necessary, but high natural fluoride levels require careful monitoring if they are used (Morovits 2005). Gillette's sewer treatment system was designed for a service population of approximately 35,000 and improvements begun in the fall of 2004 were designed to increase treatment capacity to accommodate a projected population of 41,000.

Currently, the system serves an estimated 25,000 people in the city and surrounding areas.

Water and wastewater treatment systems are provided to the community of Wright by the Wright Water and Sewer District. The Wright district's water and sewage treatment facilities were designed to serve a population of approximately 3,000, albeit with an additional sewage lagoon required when the service population reached about 2,500 people. The district is planning an additional well to increase its water supply capacity by about 30 percent. The district's facilities in Wright currently serve a population of approximately 1,400 people; essentially the entire town is served by the water system, and most lots are on the sewer system, although there are some private septic systems.

3.17.5.2 Environmental Consequences

3.17.5.2.1 Proposed Action and Alternatives 2 and 3

As discussed above, average yearly employment at the mines would increase by up to 63 positions (Cordero Rojo Mine) and mine life would be extended by from about 2 years at the Caballo Mine to approximately 10 years at the Cordero Rojo Mine under the Proposed Actions and other action alternatives. No additional demands on the existing community facilities or services in the county would be expected because little or no influx of new residents would be needed to fill new jobs. It is likely that the demand for public facilities and services will be satisfied by the existing facilities and services currently in place in Campbell County.

3.17.5.2.2 No Action Alternative

Under the No Action alternative, the coal lease applications would be rejected and the coal included in the LBA tracts under the Proposed Action or other action alternatives would not be mined. Local government facilities and services would not be affected by any additional employment at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines. Currently approved mining operations and associated employment levels would continue on the existing mine leases for from about 6 years at the Cordero Rojo Mine to approximately 16 years at the Coal Creek Mine. Portions of the LBA tracts adjacent to the existing mines would be disturbed to recover the coal in the existing leases.

As discussed in section 2.2, a decision to reject the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease a tract in the future.

3.17.6 Social Setting

3.17.6.1 Affected Environment

The social setting for coal development in the PRB, summarized in section 4.2.12.9, is described in the Task IC Report for the PRB Coal Review (BLM 2005c). That report emphasizes Campbell County and its communities as the nucleus for coal development in the PRB. The SGAC mines been in production since at least 1972 and the mines and their employees contribute to the social and economic stability of Campbell County and the City of Gillette.

3.17.6.2 Environmental Consequences

3.17.6.2.1 Proposed Action and Alternatives 2 and 3

As discussed above, employment at the mine is not anticipated to increase substantially under the Proposed Actions or Alternatives 2 and 3. Consequently, little or no change in the social setting of Campbell County or the community of Gillette would be anticipated under these alternatives.

3.17.6.2.2 No Action Alternative

Implementation of all of the No Action alternative would hasten the loss of approximately 1,500 relatively high paying mining jobs in the PRB. A majority of those losses would occur in Campbell County and the City of Gillette. Loss of the SGAC mine-related economic activity and tax revenues are described in preceding sections. These losses would likely result in a disruption in the social and economic stability of Campbell County and the city of Gillette and some population relocation, unless mine employees were able to find comparable employment within commuting distance of Gillette. Social effects of the No Action alternatives on the Town of Wright would be less substantial, because of the fewer number of employees involved and the potential for those employees to find other jobs in mines and other energy industries in Campbell County.

3.17.7 Environmental Justice

3.17.7.1 Affected Environment

Environmental Justice issues are concerned with actions that unequally impact a given segment of society either as a result of physical location, perception, design, noise, or other factors. On February 11, 1994, Executive Order 12898, "Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations", was published in the *Federal Register* (59 FR 7629). The Executive Order requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations (defined as

those living below the poverty level). The Executive Order makes it clear that its provisions apply fully to Native American populations and Native American tribes, specifically to effects on tribal lands, treaty rights, trust responsibilities, and the health and environment of Native American communities.

Communities within Campbell County, entities with interests in the area, and individuals with ties to the area all may have concerns about the presence of surface coal mines in the area. Environmental Justice concerns are usually directly associated with impacts on the natural and physical environment, but these impacts are likely to be interrelated with social and economic impacts as well. Native American access to cultural and religious sites may fall under the umbrella of Environmental Justice concerns if the sites are on tribal lands or access to a specific location has been granted by treaty right.

Compliance with Executive Order 12898 concerning Environmental Justice was accomplished through opportunities for the public to receive information on this EIS in conjunction with consultation and coordination described in section 1.6 of this document. This EIS and contributing socioeconomic analysis provide a consideration of the impacts with regard to disproportionately adverse impacts on minority and/or low-income groups, including Native Americans.

3.17.7.2 Environmental Consequences

3.17.7.2.1 Proposed Action and Alternatives 2 and 3

Economic and demographic data indicate that neither minority populations nor people living at or below the poverty level make up "meaningfully greater increment" of the total population in Gillette or Campbell County than they do in the state as a whole, or that they would be unequally impacted if the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II LBA tracts are leased under the Proposed Actions or Alternatives 2 or 3. Also, the Native American population is smaller than in the state as a whole and there are no known Native American sacred sites on or near the proposed LBA sites. Consequently, implementation of the proposed project would not adversely affect the environmental justice considerations in the area.

3.17.7.2.2 No Action Alternative

Economic and demographic data indicate that neither minority populations nor people living at or below the poverty level make up "meaningfully greater increment" of the total population in Gillette or Campbell County than they do in the state as a whole, or that they would be unequally impacted if the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II LBA tracts are leased under the Proposed Actions or Alternatives 2 or 3. Also, the Native American population is smaller than in the state as a whole and there are no known Native American sacred sites on or near the existing mines. Consequently, the No Action

alternatives would not adversely affect the environmental justice considerations in the area.

3.17.8 Regulatory Compliance, Mitigation and Monitoring

Surface coal mines are required to pay royalty and taxes as required by federal, state, and local regulations. The BLM compares the amount of coal reported as produced with the estimated amount of coal in the ground to verify that the federal coal is efficiently mined and that royalties are paid on all of the coal that is mined.

3.17.9 Residual Effects

No socioeconomic residual impacts are expected.

3.18 The Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

The NEPA regulations at 40 CFR 1502.16 require a discussion of the "relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" as part of an EIS. This requirement is duplicated in the BLM NEPA Handbook Chapter V, Section B.2.a.(3) and C.3.h.(2) (BLM 2008a).

3.18.1 Local Area

If the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts are leased, almost all components of the present ecological system, which have developed over a long period of time, would be modified as the coal is mined. In the long term, following reclamation, the land surface would be topographically lower and, although the reclaimed surface would resemble original contours, it would lack some of the original diversity of geometric form.

Mining operations and associated activities would degrade the air quality and visual resources of the area on a short-term basis. Following coal removal, removal of surface facilities, and completion of reclamation, there would be no long-term impact on air quality. The long-term impact on visual resources would be minor.

The forage and associated grazing and wildlife habitat that these four LBA tracts currently provide would be temporarily and incrementally disturbed during mining and reclamation. If the LBA tracts are mined, there would be a loss of native vegetation on a total of 11,886.9 acres (total of all Proposed Actions) up to a maximum of 12,464.8 acres (Alternatives 2 and 3) with an accompanying disturbance of grazing land and wildlife habitat. This disturbance would occur

incrementally over a period of years. Soils would be replaced and vegetation would be restored, as required by the mining plan (see sections 3.8 and 3.9). In the long term, the reclaimed lands would be returned to equivalent or better forage production capacity for domestic livestock before the performance bond is released. Long-term productivity would depend largely on postmining range management practices, which to a large extent would be controlled by private landowners.

Mining would disturb pronghorn and mule deer habitat. As discussed in section 3.10.5, potential sage-grouse habitat is scarce throughout the general project area. There would be loss and displacement of wildlife in the short term but, based on monitoring of previously reclaimed lands, it is anticipated that the reclaimed lands would provide habitat that would support a diversity of wildlife species similar to premining conditions over the long term. The diversity of species found in undisturbed rangeland would not be completely restored on the mined lands for an estimated 50 years after the initiation of disturbance. Re-establishment of mature sagebrush habitat, which is crucial for pronghorn and sage-grouse, would be expected to take even longer.

If the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts are leased and mined, depths to groundwater in the overburden and coal would increase in an area extending further to the west and south of the existing mine areas in the short term. Groundwater flow through the undisturbed aquifers near the backfilled mine pits would be interrupted until saturation levels in the backfill have risen and the rates of recharge to and discharge from the backfill equilibrate. The water levels in the coal aquifer should return to premining levels at some time after mining and CBNG development in the vicinity have ceased because recharge areas would not be disturbed when recovering the coal in the LBA tracts. Groundwater quality in and near the backfilled mine pits would be different from pre-mining conditions after reclamation, although it would remain adequate for livestock and wildlife use.

CBNG is currently being recovered from within and near these four LBA tracts, and BLM's analysis suggests that a large portion of the CBNG resources on the tracts has been recovered or would be recovered prior to mining. CBNG resources that have not been recovered from the Wyodak-Anderson zone prior to mining would be lost when the coal is removed. CBNG is composed primarily of methane, which is a greenhouse gas. A discussion of methane emissions from coal mining operations in the SGAC area is included below and methane emission from U.S. coal mining is included in chapter 4, section 4.2.14. Total U.S. methane emissions attributable to coal mining would not be likely to decrease if these four LBA tracts are not leased at this time. Likewise, it would not be likely that total U.S. methane emissions in the long term would measurably increase if these four LBA tracts are leased at this time

Short-term impacts to recreation values may occur from a reduction in big game populations due to habitat disturbance and reduction in access to some public lands. These changes would primarily impact hunting in the lease areas. However, because reclamation would result in a wildlife habitat similar to that which presently exists and access to any public lands affected by mining would be restored, there should be no long-term adverse impacts on recreation.

The short- and long-term economy of the region would be enhanced as a result of the Proposed Actions and action alternatives. Leasing and subsequently mining the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts would extend the life of the existing mines by just over 10 additional years, depending on which LBA tract and which alternative is selected.

3.18.1.1 Human Health Impact Assessment

In 2008, public concerns were brought to BLM's attention in regard to conducting human health impact assessments (HIAs) in the PRB where coal mining activities occur. An HIA is a method used in assessing potential impacts of a proposed project on human health. HIAs examine health on a broad scale, including social, emotional, and cultural impacts as well as physical impacts. HIAs rely on available scientific data, public testimony, and modeling to predict potential health impacts.

BLM does not have jurisdiction in regard to conducting specific human health assessments. However, BLM invited the Wyoming Department of Health/Environmental Health Section and the U.S. Center for Disease Control and Prevention to review and provide comment on the South Gillette Area Coal Lease Applications EIS. Neither agency was able to provide detailed information due to time and staffing constraints. Information regarding general aspects of HIA are included in sections 3.4 (Air Quality), 3.5 (Water Resources), 3.14 (Noise), 3.16 (Hazardous and Solid Waste), and 3.17 (Socioeconomics). While this information may not provide a thorough discussion of all aspects of HIA, it is a summary of credible scientific evidence that is relevant to evaluating reasonably foreseeable significant impacts on human health.

Public concerns included emissions from coal mining activities like particulate matter and nitrogen oxide exposure and their potential impact on the health of people living in the vicinity of surface coal mines located in the eastern PRB.

Air pollution is controlled by state and federal air quality regulations and standards established under the federal Clean Air Act Amendments. State implementation plans are in place to ensure proposed actions like coal mining comply with all associated air quality regulations and criteria. The Wyoming Ambient Air Quality Standards (WAAQS) are stricter than the National Ambient Air Quality Standards (NAAQS) and are enforced by WDEQ.

As described in section 3.4.2.3 of this EIS, the WDEQ/AQD developed a Natural Events Action Plan for the coal mines of the PRB. The plan, based on EPA Natural Event Policy guidance, identifies potential control measures for protecting public health and minimizing exceedances of the PM_{10} NAAQS.

All mines are required to conduct air quality modeling to show that their proposed operations will comply with the WAAQS and NAAQS, and they are required to monitor to demonstrate that their actual air emissions do not exceed the standards. The WDEQ/AQD coal mining permit process requires air quality modeling of the primary air pollutants PM_{10} and NO_2. Section 3.4.2.3 in this EIS addresses air quality mitigation measures that WDEQ/AQD implemented in order to prevent exceedances of the WAAQS and NAAQS by PRB surface coal mines.

As stated above and as discussed in section 3.4, mining operations and associated activities would effectively degrade the air quality in the vicinity on a short-term basis. Following coal removal, removal of all surface facilities, and completion of reclamation, there would be no long-term impact on air quality.

According to section 3.5.1, postmining groundwater quality is expected to improve after one pore volume of water moves through the backfill. In general, the mine backfill groundwater TDS can be expected to be quite similar to the premining overburden aquifer, and meet Wyoming Class III standards for use as stock water.

While mining is in progress, surface water quality (see section 3.5.2) would continue to be protected by directing surface runoff from affected areas to various sediment control structures, including sediment ponds, traps, ditches, sumps, and mine pits. Under normal conditions, exceedances of effluent limitations are not expected in the future as mining extends into new drainages and additional sediment control facilities are added. After mining and reclamation are complete, surface water flow and quality would approximate premining conditions.

Noise levels on the LBA tracts would be increased considerably by mining activities such as blasting, loading, hauling, and possibly in-pit crushing. Because of the remoteness of the tracts and because mining is already on going in the area, noise would have few off-site impacts. No residual impacts to noise are expected.

As discussed in section 3.16, wastes generated by mining the LBA tracts would be handled in accordance with the existing regulations using the procedures currently in use and in accordance with WDEQ-approved waste disposal plans at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines. Little or no change in the social setting of Campbell County or the community of Gillette would be anticipated under these alternatives. No residual hazardous and solid waste impacts are expected.

Social setting impacts are discussed in section 3.17.6. The SGAC mines have been in production since at least 1972 and the mines and their employees contribute to the social and economic stability of Campbell County and the City of Gillette. No socioeconomic residual impacts are expected.

Coal mines (including the four SGAC mines) are also under the jurisdiction of the Mine Safety and Health Administration (MSHA). The mission of the MSHA is to "administer the provisions of the *Federal Mine Safety and Health Act of 1977* (Mine Act), as amended by the *Mine Improvement and New Emergency Response Act of 2006* (MINER Act), and to enforce compliance with mandatory safety and health standards as a means to eliminate fatal accidents; to reduce the frequency and severity of nonfatal accidents; to minimize health hazards; and to promote improved safety and health conditions in the Nation's mines" (USDOL 2009). While an HIA is not within MSHA's authorization, the agency does monitor and enforce some of the health and safety standards for mining that are related to HIA issues.

3.18.2 Greenhouse Gas Emissions

This section will address greenhouse gas emissions as specifically related to the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines, the mines adjacent to the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts, respectively.

Ongoing scientific research has identified the potential impacts of anthropogenic (from human activities) greenhouse gas (GHG) emissions, and changes in biologic carbon sequestration on the global climate. Through complex interactions on a regional and global scale, these changes cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat radiated by the earth back into space. Although natural GHG levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused equivalent carbon dioxide (CO_2e) concentrations to increase dramatically, and are likely to contribute to overall global climatic changes. As with any field of scientific study, there are uncertainties associated with the science of climate change. This does not imply that scientists do not have confidence in many aspects of climate change science. Some aspects of the science are known with virtual certainty, because they are based on well-known physical laws and documents trends (EPA 2008a).

Climatic change analyses are comprised of several factors, including GHG emissions, land use management practices, and the albedo effect (the cycle of increased temperature of the environment resulting from increased absorption of normally reflected light). In this chapter, the effects of recent global climate change on the environment in the area of the proposed action and alternatives have been identified. It is assumed that existing land and resource conditions within the analysis area have been and will continue to be affected by climate

change under all alternatives. National and regional data that are available have been referenced, including a recent comprehensive report, *The Effects of Climate Change on Agriculture, Land Resources, Water Resources and Biodiversity in the United States* (U.S. Climate Change Science Program 2008).

Specific levels of significance have not yet been established for GHG emissions, and given the state of the science; it is not yet possible to associate specific actions with the specific climate impacts. Since tools necessary to quantify incremental climatic changes associated with these GHG emissions are presently unavailable, the analysis cannot reach conclusions as to the magnitude or significance of the emissions on climate change. The impacts of climate change represent the cumulative impacts of, among other factors, all worldwide GHG and emissions and land use management practices. To the extent that emission data were available or could be inferred from representative-data, potential GHG emissions have been identified that could result from development of the proposed LBA tracts, as well as emissions that will result from selection of the no action alternative. The analysis provides a qualitative measure of the incremental change on GHG emissions resulting from the proposed LBA tracts, as compared to no action. The analysis also provides a measure of the incremental change resulting from the LBA tracts in relation to GHG emissions from all current coal mining."

The greenhouse effect is a theory that certain gases in the atmosphere impede the release of radiation from the earth, trapping heat in the atmosphere like glass over a greenhouse. Many greenhouse gases occur naturally in the atmosphere, such as carbon dioxide (CO_2), methane (CH_4), water vapor, ozone (O_3), and nitrous oxide (N_2O), while others are synthetic, such as chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), as well as sulfur hexafluoride (SF_6) (NOAA 2009). If the coal in the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts is leased and mined, additional GHGs would be released into the atmosphere.

As discussed in chapter 1, BLM does not authorize mining through the issuance of a federal coal lease. WDEQ, with oversight from OSM, has regulatory authority in issuing permits to mine coal in Wyoming. However, BLM considers the impacts of mining coal in this EIS because it is a logical consequence of issuing a maintenance lease to an existing coal mine.

The use of the coal after it is mined is not determined at the time of leasing. However, almost all coal that is currently being mined in the Wyoming PRB is being used to generate electricity by coal-fired power plants. A discussion of emissions and by-products that are generated by burning coal to produce electricity is included in chapter 4, section 4.2.14 of the EIS and a more complete discussion of the current status of global climate change and cumulative considerations is included section 4.2.14.1.

Not all four applicant mines have completed a GHG emissions inventory, although mines both within and outside the general South Gillette analysis area conducted inventories of expected emissions that occurred in 2007. These mines also projected emissions for a typical year of operations at the mines if additional lands are leased and mined. Emissions are measured as metric tons of CO_2, a conversion to put any of the various gases emitted, i.e. methane or nitrous oxides, into the equivalent greenhouse effect as compared to CO_2. The completed inventories included emissions for sources, such as all types of carbon fuels used in mining operations, electricity used on site (facilities lighting and operation, lighting to illuminate roads, power for electrically operated equipment, and conveyors), and mining processes (blasting, methane released from mined coal, carbon sink gain/loss from disturbed and reclaimed lands, and spontaneous combustion). An additional category contributing to CO_2 emissions, which was not included in CO_2 emissions estimates for the four applicant mines due to a lack of information, included rail transport, both on-site and to the buyers.

The expected CO_2 emissions that occurred in 2007 for the mines that have not completed emissions inventories were estimated by assuming the CO_2 emission ratios (CO_2 per million tons of coal produced, CO_2 per million bank cubic yards of overburden moved, and CO_2 per acres of disturbance) for the mines that completed emissions inventories would be equivalent. The correlations were based on the 2007 coal production, overburden production, and disturbance acres (facilities plus active pit acres) for three source types (fuel, electricity, and mining process) compared to Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines' 2007 coal production, overburden production, and disturbance acres (WWC 2009a). Since the combined CO_2 emissions for SGAC mines are estimated, based on limited information, the estimated values are tentative. For the purpose of this analysis, these combined total values are only included here as a means of obtaining a representation of potential CO_2 emissions should the four SGAC tracts be leased and mined.

CO_2 emissions are projected to increase at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines if the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts are added to the mining operations (table 3-20). The increase in CO_2 emissions are expected to result from the additional fuels (especially diesel) that would be used in consideration of the increased coal and overburden haul distances, as well as increased use of electricity and explosives related to increasing overburden thicknesses. The incremental changes with the addition of these four LBA tracts to the applicant mines' operations represent the estimated CO_2 emissions for the Proposed Actions as well as Alternatives 2 and 3. Estimates assume that the combined annual production rate from these four mines is 127.5 million tons.

The Center for Climate Strategies estimates that activities in Wyoming will account for approximately 60.3 million metric tons of gross CO_2 emissions in 2010 and 69.4 million metric tons in 2020 (Center for Climate Strategies 2007). Using those

Table 3-20. Estimated Annual Equivalent CO_2 Emissions* at the SGAC Mines.

Source	2007	With LBA Tracts
Fuel	332,419	675,080
Electricity	267,671	366,983
Mining Process	116,120	139,856
Total of Three Sources	**716,210**	**1,181,920**

* Equivalent CO_2 in metric tons
Source: WWC 2009a

projections, the 2007 mine emissions total (table 3-20) represents 1.2 percent of the 2010 state-wide emissions. With the addition of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts, the estimated total emissions at the four applicant mines would represent 1.7 percent of the projected 2020 state-wide emissions.

As mentioned above, the CO_2 estimates for the combined Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts in table 3-20 include projected methane emissions vented from exposed unmined coal. The estimated annual amount of CO_2 emissions from vented methane would be approximately 97,100 metric tons, or about 8.2 percent of the estimated total annual CO_2 emissions from mining the four tracts (WWC 2009a). The total methane emission from anthropogenic sources in the U.S. in 2007 was estimated at 699.9 million metric tons (USDOE 2008a). Based on 2007 production from the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines, the estimated annual methane emissions vented from recovered coal was 0.08 million metric tons CO_2 (WWC 2009a), or about 0.01 percent of the total 2007 U.S. methane emissions from anthropogenic sources.

As discussed in chapter 2, under the No Action alternative, the life of the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines would be extended at about current levels for approximately 16 years while the mines recover their remaining estimated 1,564 million tons of recoverable coal reserves. Under the Proposed Actions or Alternatives 2 or 3, the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines' contributions to greenhouse gas emissions would be extended by just over 10 additional years.

Please see section 4.2.14 for an assessment of cumulative impacts related to greenhouse gases, and how the proposed action and alternatives contribute.

3.18.3 Regulatory Compliance, Mitigation and Monitoring

CO_2, CH_4, water vapor, O_3, and N_2O are recognized as greenhouse gases. Although GHGs are not regulated at this time, EPA is required by the Clean Air Act to regulate emissions of six common "criteria air pollutants", including O_3 and nitrogen dioxide (NO_2), from an air quality standpoint. O_3 and NO_2 emissions are monitored at the Thunder Basin National Grassland and South Campbell County

air quality monitoring sites and monitoring results are included in the EPA AirData database (EPA 2009a). NO_2 is not a greenhouse gas but it can react with other components of the atmosphere to form O_3. O_3 and NO_2 emissions relating to the mining of the SGAC LBA tracts are discussed in section 3.4. Voluntarily mitigation measures to reduce mine-specific greenhouse gas emissions currently in place at some PRB mines include:

- minimizing blast size to the extent possible to reduce CO_2 and NO_2 emissions;
- using different blends of ANFO and slurries and gels used in coal and overburden blasts to reduce CO_2 and NO_2 emissions; and
- reducing fuel consumption by restricting equipment idling times, maintaining equipment (vehicles, compressors, generators, etc.) to improve fuel efficiency, focusing on high-efficiency engines for replacement, establishing overland conveyors to reduce coal hauling distances, and installing in-pit refueling facilities to reduce travel distance for fueling, thereby reducing CO_2, NO_2, and N_2O emissions.

3.19 Irreversible and Irretrievable Commitments of Resources

The major commitment of resources would be the mining and consumption of 731.4 million tons (Proposed Action for all four LBA tracts) up to a maximum of 761.0 million tons (action alternatives for all four LBA tracts) of coal to be used for electrical power generation. CBNG that is not recovered prior to mining would also be irreversibly and irretrievably lost (see additional discussion of the impacts of venting CBNG to the atmosphere in section 3.18 and 4.2.14). It is estimated that 1 to 2 percent of the energy produced would be required to mine the coal, and this energy would also be irretrievably lost.

The characteristics of topsoil on approximately 11,846 acres (Proposed Action for all four LBA tracts) up to a maximum of approximately 12,465 acres (action alternatives for all four LBA tracts) would be irreversibly changed. Soil formation processes, although continuing, would be irreversibly altered during mining-related activities. Newly formed soil material would be unlike that in the natural landscape.

Direct and indirect wildlife deaths caused by mining operations or associated activity would be an irreversible loss.

Loss of life may conceivably occur due to the mining operations and vehicular and train traffic. On the basis of surface coal mine accident rates in Wyoming as determined by the Mine Safety and Health Administration (1997) for the 10-year period 1987-1996, fatal accidents (excluding contractors) occur at the rate of 0.003 per 200,000 man-hours worked. Disabling (lost-time) injuries occur at the

rate of 1.46 per 200,000 man-hours worked. Any injury or loss of life would be an irretrievable commitment of human resources.

Disturbance of all known historic and prehistoric sites on the mine areas would be mitigated to the maximum extent possible. However, accidental destruction of presently unknown archeological or paleontological values would be irreversible and irretrievable.

4.0 CUMULATIVE ENVIRONMENTAL CONSEQUENCES

Cumulative impacts result from the incremental impacts of an action added to other past, present, and reasonably foreseeable future actions, regardless of who is responsible for such actions. Cumulative impacts can result from individually minor, but collectively significant, actions occurring over time.

This section summarizes the cumulative impacts that are occurring as a result of existing development in the Powder River Basin (PRB)[1] and considers how those impacts would change if other projected development in the area occurs and if the four lease by application (LBA) tracts in the south Gillette general analysis area are leased and mined.

The Bureau of Land Management (BLM) completed three regional environmental impact statements (EISs) evaluating the potential cumulative impacts of surface coal development in the 1970s and early 1980s (BLM 1974, 1979, and 1981). A draft document for a fourth regional EIS was prepared and released in 1984 (BLM 1984). Since those regional EISs were prepared, BLM has prepared a number of National Environmental Policy Act of 1969 (NEPA) analyses evaluating coal leasing actions and oil and gas development in the PRB. Each of these NEPA analyses includes an analysis of cumulative impacts in the Wyoming PRB.

Currently, the BLM is completing a regional technical study, called the PRB Coal Review, to help evaluate the cumulative impacts of coal and other mineral development in the PRB. The PRB Coal Review consists of three tasks:

- Task 1 identifies existing resource conditions in the PRB for the baseline year (2003) and, for applicable resources, updates the BLM's 1996 status check for coal development in the PRB.
- Task 2 defines the past and present development activities in the PRB and their associated development levels as of 2003 and develops a forecast of reasonably foreseeable development in the PRB through 2020. The reasonably foreseeable activities fall into three broad categories: coal development (coal mine and coal-related), oil and gas development (conventional oil and gas, coal bed natural gas, and major transportation pipelines), and other development, which includes development that is not energy-related as well as other energy-related development.
- Task 3 predicts the cumulative impacts that could be expected to occur to air, water, socioeconomic, and other resources if the development occurs as projected in the forecast developed under Task 2.

A series of reports have been prepared to present the results of the PRB Coal Review task studies. The Task 1, 2, and 3 reports represent components of a

1 Refer to page xxiii for a list of abbreviations and acronyms used in this document.

technical study of cumulative development in the PRB; they do not evaluate specific proposed projects, but they provide information that BLM is using to evaluate the cumulative impacts that would be expected to occur if specific projects or applications, such as the four LBA tracts in the general South Gillette analysis area, are approved. The Task 1 reports, which include air quality conditions, water resources conditions, social/economic conditions, and other resource conditions, and the Task 2 Report have been completed. The Task 3 reports for air quality conditions, social/economic conditions, and other resource conditions have been completed. The Task 3 evaluation of water resource conditions is in progress. The information in these reports is summarized later in this chapter, and the completed reports are available for viewing at the BLM offices in Casper and Cheyenne and on the Wyoming BLM website at http://www.blm.gov/wy/st/en/programs/energy/Coal_Resources/PRB_Coal/prbdocs.html.

The PRB includes portions of northeastern Wyoming and southeastern Montana. The Wyoming portion of the PRB is the primary focus of the PRB Coal Review reports. The Montana portion of the PRB is included in the Task 2 Report and in the Task 1 and 3 air resources studies. For the majority of resources in the Task 1 reports and for the Task 2 Report, the Wyoming portion of the PRB Coal Review study area encompasses all of Campbell County, all of Sheridan and Johnson Counties outside of the Bighorn National Forest, and the northern portion of Converse County (figure 4-1). For some components of the Task 2 Report and for the Task 1 and 3 air resource studies, the Montana PRB Coal Review study area includes portions of Big Horn, Custer, Powder River, Rosebud, and Treasure Counties. For several resources, the Task 1 and Task 3 study areas include only potentially affected portions of the Wyoming PRB Coal Review study area; for other resources, the study area extends outside of Wyoming and Montana because the impacts would extend beyond the PRB. For example, the groundwater drawdown is evaluated in the area surrounding and extending west of the mines, because that is the area where surface coal mining operations would impact groundwater resources; but air quality impacts are evaluated over a multi-state area because they would be expected to extend beyond the PRB.

Section 4.1 summarizes the information presented in the PRB Coal Review Task 1 and Task 2 reports. Section 4.2 summarizes the predicted cumulative impacts to air, water, socioeconomic, and other resources presented in the PRB Coal Review Task 3 reports.

4.1 Past and Present and Reasonably Foreseeable Development

Past, present, and reasonably foreseeable development in the Wyoming PRB are considered in the Task 1 and Task 2 reports for the PRB Coal Review. The Task 1 reports describe the existing situation as of the end of 2003, which reflects the past and present levels of development. The Task 2 Report defines the past and present and reasonably foreseeable development activities in the PRB as of the end of 2003 and projects reasonably foreseeable development in the Wyoming

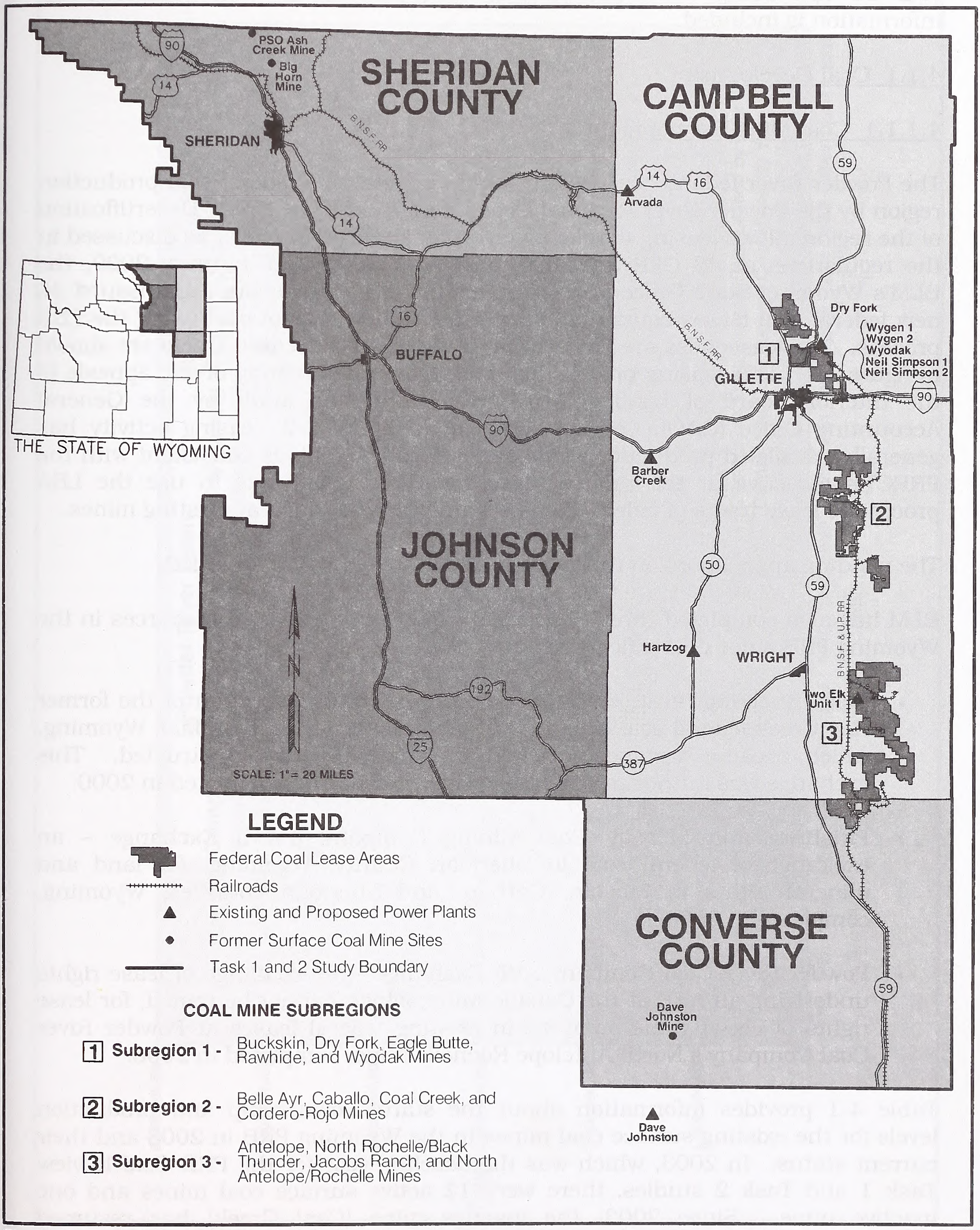


Figure 4-1. Wyoming Study Area for PRB Coal Review Studies Evaluating Current and Projected Levels of Development.

PRB through 2020. When appropriate, more current, i.e. 2007, development information is included.

4.1.1 Coal Development

4.1.1.1 Coal Mine Development

The Powder River federal coal region was decertified as a federal coal production region by the Powder River Regional Coal Team (PRRCT) in 1990. Decertification of the region allows leasing to take place on an application basis, as discussed in the regulations at 43 CFR 3425.1-5. Between 1990 and January 2009, the BLM's Wyoming State Office held 25 competitive coal lease sales and issued 20 new federal coal leases containing almost 5.8 billion tons of coal using the LBA process. The lease sales are listed in table 1-1, and the leased tracts are shown in figure 1-1. This leasing process has undergone the scrutiny of two appeals to the Interior Board of Land Appeals (IBLA) and one audit by the General Accounting Office (GAO). As can be seen in figure 4-2, leasing activity has generally paralleled production since decertification. This is consistent with the PRRCT's objective at the time of decertification, which was to use the LBA process to lease tracts of federal coal to maintain production at existing mines.

The pending applications in the Wyoming PRB are shown in table 1-2.

BLM has also completed three exchanges involving federal coal resources in the Wyoming PRB since decertification:

- Belco Exchange – an exchange of lease rights for a portion of the former Hay Creek federal coal tract for lease rights to coal near Buffalo, Wyoming, which became unmineable when Interstate 90 was constructed. This exchange was authorized by Public Law 95-554 and completed in 2000.

- Pittsburg and Midway Coal Mining Company (P&M) Exchange – an exchange of federal coal in Sheridan County, Wyoming, for land and mineral rights in Lincoln, Carbon, and Sheridan counties, Wyoming, completed in 2004.

- Powder River Coal Company AVF Exchange – an exchange of lease rights underlying an AVF at the Caballo Mine, which cannot be mined, for lease rights of equal value adjacent to existing federal leases at Powder River Coal Company's North Antelope Rochelle Mine, completed in 2006.

Table 4-1 provides information about the status, ownership and production levels for the existing surface coal mines in the Wyoming PRB in 2003 and their current status. In 2003, which was the baseline year for the PRB Coal Review Task 1 and Task 2 studies, there were 12 active surface coal mines and one inactive mine. Since 2003, the inactive mine (Coal Creek) has resumed operations and the North Rochelle Mine has been incorporated into the Black Thunder Mine following its purchase by the operator of the Black Thunder Mine.

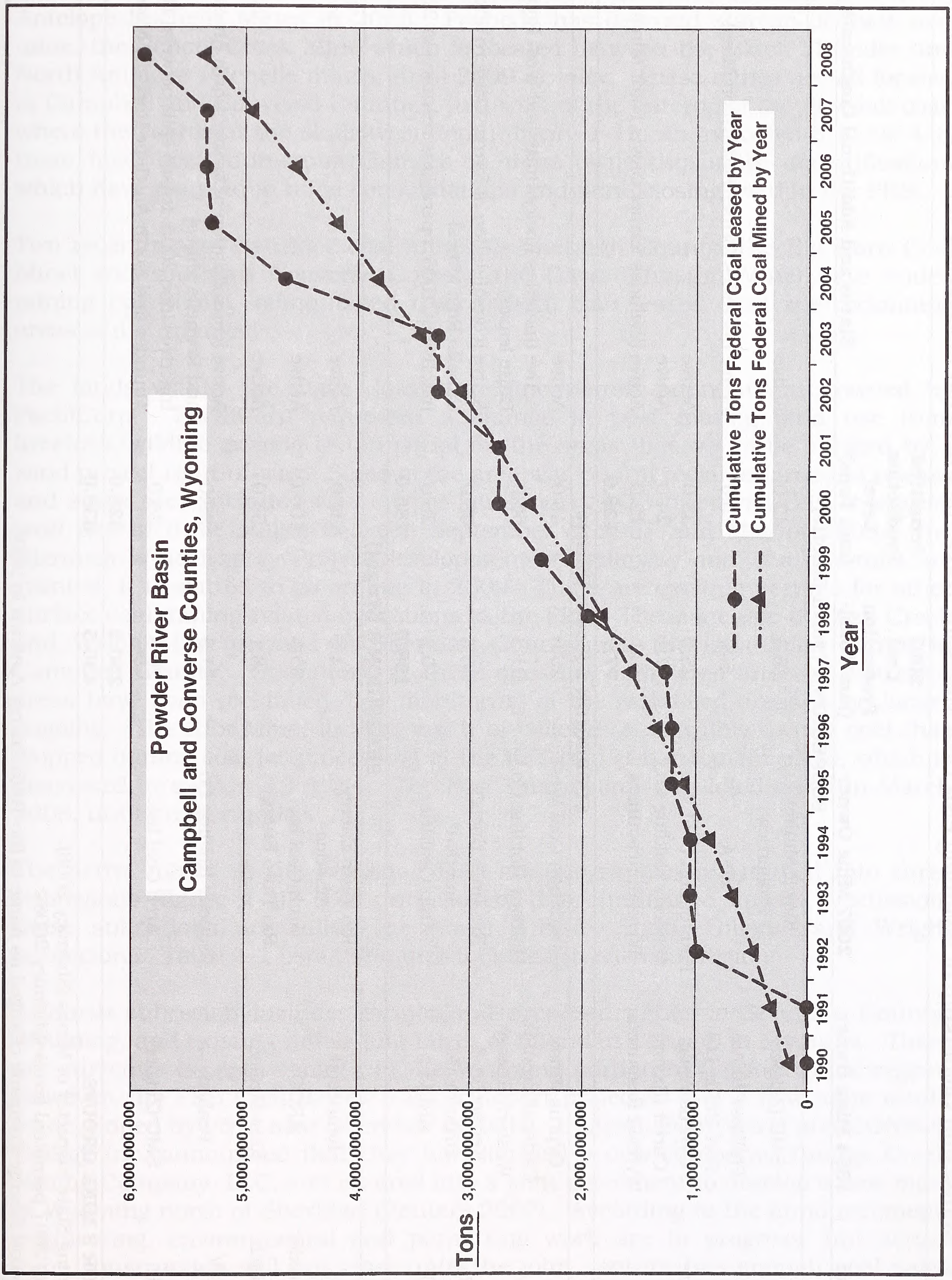


Figure 4-2. Tons of Federal Coal Leased Versus Tons of Coal Mined Since 1990.

Table 4-1. Status and Ownership of Wyoming PRB Coal Mines for 2003, the PRB Coal Review Baseline Year, and for 2007.

2003 Mine	1994 Mine Owner	2007 Mine Owner	2007 Coal Production (mm Tons)[1]	Permitted Production Level (mm Tons)[2]	Status and Additional Comments
SUBREGION 1 (North Gillette)					
Buckskin	SMC (Zeigler)	Kiewit Mining Properties	25.3	42.0	Active
Dry Fork	Phillips/WFA & Fort Union Ltd	WFA	5.3	15.0	Active (includes former Fort Union Mine)
Eagle Butte	Cyprus-Amax	Foundation Coal West	25.0	35.0	Active
Rawhide	Carter (Exxon)	Peabody Holding Co.	17.1	24.0	Active
Wyodak	Wyodak Resources	Wyodak Resources	5.0	12.0	Active (includes former Clovis Point Mine)
Total			**77.7**	**128.0**	
SUBREGION 2 (South Gillette)					
Belle Ayr	Cyprus-Amax	Foundation Coal West	26.6	45.0	Active
Caballo	Carter (Exxon) & Western Energy	Peabody Holding Co.	31.2	50.0	Active (includes Rocky Butte and West Rocky Butte leases)
Cordero Rojo	Kennecott & Drummond	Rio Tinto Energy America[3]	40.5	65.0	Active (consolidation of former Cordero and Caballo Rojo Mines)
Coal Creek	ARCO	Arch Coal Inc.	10.2	25.0	Inactive in 2003, operations resumed in 2006
Total			**108.5**	**185.0**	
SUBREGION 3 (Wright)					
Antelope	Kennecott	Rio Tinto Energy America[3]	34.5	36.0	Active
Black Thunder	ARCO	Arch Coal Inc.	65.3	100.0	Active
Jacobs Ranch	Kerr-McGee	Rio Tinto Energy America[3]	38.1	55.0	Active
N. Antelope/ Rochelle	Peabody	Peabody Holding Co.	91.5	99.0	Active (consolidation of former North Antelope and Rochelle Mines)
N. Rochelle	SMC (Zeigler)	Arch Coal Inc.	20.9	35.0	Inactive since 2005, leases split between Black Thunder and North Antelope Rochelle Mines
Total			**250.3**	**325.0**	
TOTAL FOR 3 MINE GROUPS			**436.5**	**638.0**	

1 Wyoming State Inspector of Mines (Shamley 2008).
2 WDEQ 2007 permitted levels (Shamley 2008).
3 Kennecott Energy Company changed its name to Rio Tinto Energy America in 2006.

The North Rochelle Mine leases were divided between Black Thunder and North Antelope Rochelle Mines in 2006. Peabody has deferred startup of their new mine, the School Creek Mine which is located between the Black Thunder and North Antelope Rochelle mines, until 2009 or later. These mines are all located in Campbell and Converse Counties, just west of the outcrop of the Wyodak coal, where the coal is at the shallowest depth (figure 1-1). As indicated in table 4-1, there have been numerous changes in mine ownership since decertification, which have resulted in mine consolidations and mine closings within the PRB.

Two recently active surface coal mines in Sheridan County (the Big Horn Coal Mine) and southern Converse County (the Dave Johnston Mine) have ended mining operations, relinquished their federal coal leases, and are reclaiming areas of disturbance.

The lands within the Dave Johnston Mine permit boundary are owned by PacifiCorp. PacifiCorp requested a change in post mining land use from livestock/wildlife grazing to Industrial for the areas that would be affected by a wind project right-of-way. Some of the area was on full reclamation bond release and some area included was on pre-law lands. LQD approved this change of land use in three stages between September of 2007 and May of 2008. The Glenrock Wind Energy Project development is underway and, if all permits are granted, it is slatted to go on line in 2009. There are existing permits for other surface coal mining-related operations in the PRB. These include the Ash Creek and Welch Mine permits in Sheridan County and the Izita Mine permit in Campbell County. Operations at these sites are completed and the disturbed areas have been reclaimed, but monitoring of the reclaimed areas is no longer ongoing. The KFx Mine, located north of Gillette on privately owned coal, has stopped mining coal for processing at the KFx coal enhancement plant, which is discussed in section 4.1.1.2.4. The Fort Union plant was idled down in March 2008, until further notice.

The active mines in the Wyoming PRB are geographically grouped into three subregions (figure 4-1). For purposes of this cumulative impact discussion, these subregions are called the North Gillette, South Gillette, and Wright subregions. Table 4-1 lists the mines included in each subregion.

A fourth subregion includes former and proposed mines in Sheridan County, Wyoming, and existing mines just north of Sheridan County, in Montana. There are currently no active mines in the Wyoming portion of the fourth subregion. However, the PRB Coal Review Task 2 Report projected that a new mine would be developed by P&M near Sheridan by 2010. In April, 2007, P&M and CONSOL Energy Inc. announced that they have formed a new company, Youngs Creek Mining Company, LLC, and entered into a joint agreement to develop a new mine in Wyoming north of Sheridan (Reuters 2007). According to the announcement, engineering, environmental and permitting work are in progress, but actual mine construction will not start until the joint venture has enough coal sales under contract to justify the investment. The coal reserves included in this project are all privately owned.

The surface coal mines listed in table 4-1 currently produce over 96 percent of the coal produced in Wyoming each year. Since 1989, coal production in the PRB has increased by an average of 6 percent per year. The increasing production is primarily due to increasing sales of low-sulfur, low-cost PRB coal to electric utilities who must comply with the Phase I requirements of Title III of the 1990 Clean Air Act Amendments. Electric utilities account for 97 percent of Wyoming's coal sales. In 2003 (the baseline year for the PRB Coal Review), more than 33 percent of the coal mined in the United States came from the Wyoming PRB. By 2007, about 38 percent of the coal mined in the United States came from the Wyoming PRB (USDOE 2008b).

BLM estimates that the surface coal mines listed in table 4-1 currently have about 125,180 acres of federal coal leased in Campbell and Converse Counties. This represents approximately 4.1 percent of Campbell County, where the majority of the leases are located.

Task 2 of the PRB Coal Review projected coal development into the future for the years 2010, 2015, and 2020. Due to the variables associated with future coal production, two projected coal production scenarios (representing an upper and a lower production level) were developed to bracket the most likely foreseeable regional coal production level. The basis for the projected production levels included:

1) an analysis of historic PRB production levels in comparison to the gross domestic product and national coal demand;

2) an analysis of PRB coal market forecasts that model the impact of gross domestic product growth, potential regulatory changes affecting coal-fired power plants, and mining and transportation costs on PRB coal demand;

3) the availability, projected production cost, and quality of future mine-specific coal reserves within the PRB region; and

4) the availability of adequate infrastructure for coal transportation.

The projected upper and lower production levels subsequently were allocated to the Wyoming PRB subregions, discussed above, and to individual mines based on past market shares. Individual mine production levels were reviewed relative to potential future production constraints (e.g., loadout capacities), permitted production levels, mining costs, and coal quality. Then the projected future production was aggregated on a subregion basis. The actual 2003 production level and the two projected coal production scenarios for 2010, 2015, and 2020 are shown in figure 4-3 and tables 4-2 and 4-3. The 2007 production level is shown on figure 4-3 as a reference point.

Tables 4-2 and 4-3 also show the cumulative coal mining disturbance as of the baseline year and the cumulative coal mine disturbance projected for the future years for the upper and lower coal production scenarios. In these tables, the

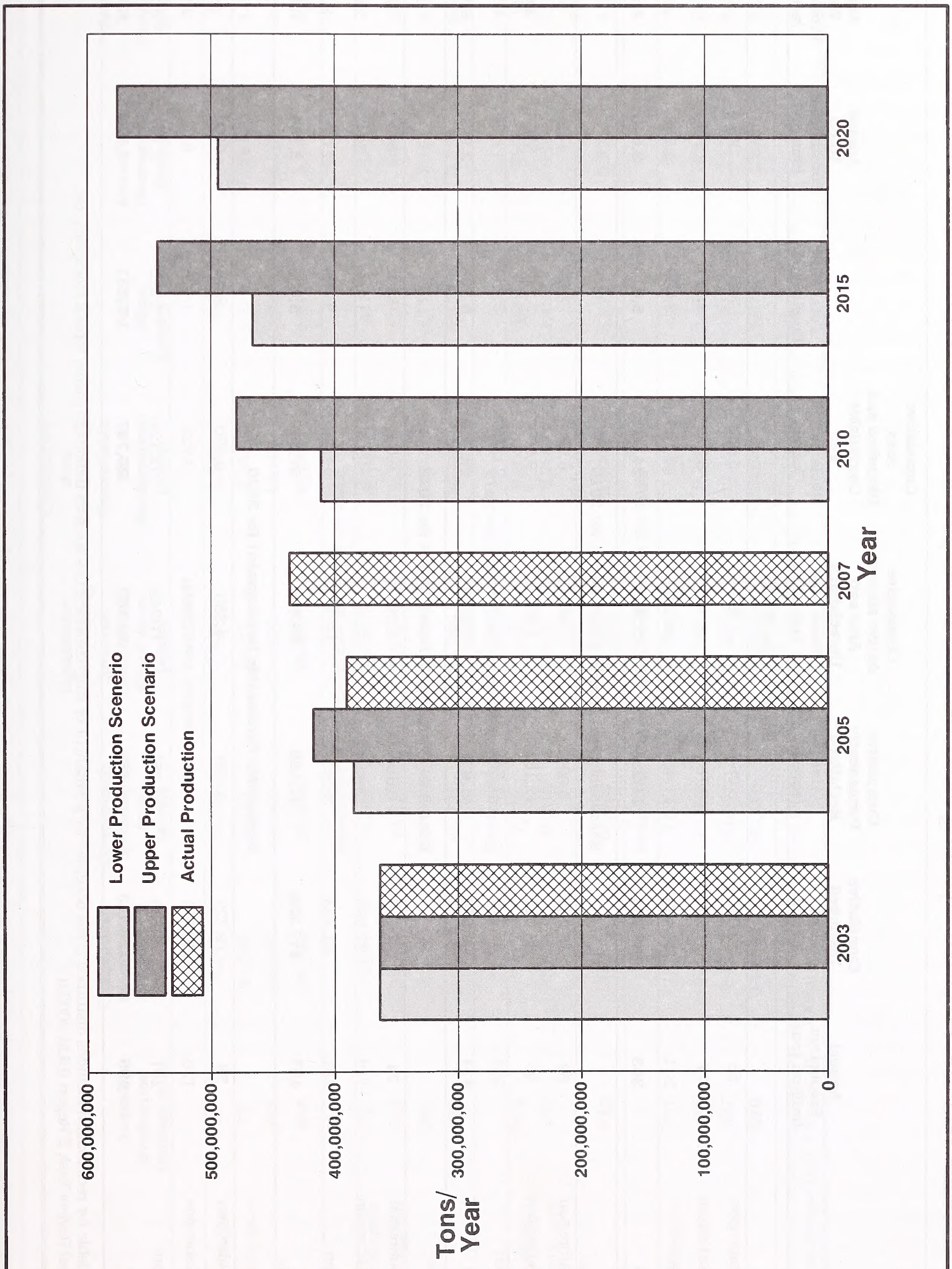


Figure 4-3. Projected Total Coal Production from Campbell and Converse Counties Under the Lower and Upper Production Scenarios.

Table 4-2. Baseline Year and Projected Wyoming PRB Coal Mine Development, Lower Coal Production Scenario.

Subregion	Annual Production (million tons)	Cumulative Disturbed Area (acres)	Cumulative Permanently Reclaimed Area (acres)	Cumulative Active Mining Area and Unreclaimed Mined Area (acres)	Cumulative Area Disturbed and Unavailable For Reclamation[1] (acres)	Total Mine Employment	Annual Water Consumption (mmgpy)	Annual Water Production (acre-ft)
Baseline year (2003)								
North Gillette Subregion	55	12,047	3,054	3,360	5,633	746	387	586
South Gillette Subregion	77	21,249	6,783	6,107	8,359	1,174	544	1,373
Wright Subregion	231	35,498	11,401	13,992	10,105	3,090	1,709	2,295
Total for 2003	**363**	**68,794**	**21,238**	**23,459**	**24,097**	**5,010**	**2,640**	**4,254**
Reasonably Foreseeable Development for 2010								
North Gillette Subregion	62	15,231	5,004	3,968	6,260	787	441	505
South Gillette Subregion	95	28,021	12,183	6,830	9,008	1,323	656	2,072
Wright Subregion	254	55,410	27,751	16,588	11,070	3,153	1,874	4,354
Total for 2010	**411**	**98,662**	**44,938**	**27,386**	**26,338**	**5,263**	**2,971**	**6,931**
Reasonably Foreseeable Development for 2015								
North Gillette Subregion	74	17,457	6,654	4,202	6,601	830	543	505
South Gillette Subregion	112	32,356	15,683	7,314	9,359	1,369	764	2,072
Wright Subregion	281	67,423	38,851	16,983	11,589	3,186	2,077	4,354
Total for 2015	**467**	**117,236**	**61,188**	**28,499**	**27,549**	**5,405**	**3,384**	**6,931**
Reasonably Foreseeable Development for 2020								
North Gillette Subregion	78	19,729	8,429	4,350	6,950	840	569	505
South Gillette Subregion	126	36,994	19,683	7,589	9,723	1,476	845	2,072
Wright Subregion	291	80,720	51,351	17,243	12,124	3,215	2,157	4,354
Total for 2020	**495**	**137,443**	**79,463**	**29,182**	**28,797**	**5,531**	**3,571**	**6,931**

[1] Area unavailable for reclamation includes disturbed areas occupied by permanent or long-term facilities such as buildings, roads, topsoil stockpiles, etc.
Source: PRB Coal Review Task 2 Report (BLM 2005a)

Table 4-3. Baseline Year and Projected Wyoming PRB Coal Mine Development, Upper Coal Production Scenario.

Subregion	Annual Production (million tons)	Cumulative Disturbed Area (acres)	Cumulative Permanently Reclaimed Area (acres)	Cumulative Active Mining Area and Unreclaimed Mined Area (acres)	Cumulative Area Disturbed and Unavailable For Reclamation[1] (acres)	Total Mine Employment	Annual Water Consumption (mmgpy)	Annual Water Production (acre-ft)
Baseline Year (2003)								
North Gillette Subregion	55	12,047	3,054	3,360	5,633	746	387	586
South Gillette Subregion	77	21,249	6,783	6,107	8,359	1,174	544	1,373
Wright Subregion	232	35,498	11,401	13,992	10,105	3,090	1,709	2,295
Total for 2003	**363**	**68,794**	**21,238**	**23,459**	**24,097**	**5,010**	**2,640**	**4,254**
Reasonably Foreseeable Development for 2010								
North Gillette Subregion	78	15,911	5,404	4,217	6,290	811	570	505
South Gillette Subregion	117	29,279	13,416	7,536	8,328	1,375	807	2,072
Wright Subregion	284	57,258	27,951	18,236	11,070	3,153	2,101	4,354
Total for 2010	**479**	**102,448**	**46,771**	**29,989**	**25,688**	**5,339**	**3,478**	**6,931**
Reasonably Foreseeable Development for 2015								
North Gillette Subregion	104	18,490	7,329	4,500	6,660	905	785	505
South Gillette Subregion	138	35,624	18,616	8,248	8,760	1,431	952	2,072
Wright Subregion	301	70,431	39,451	19,391	11,589	3,186	1,834	4,354
Total for 2015	**543**	**124,545**	**65,396**	**32,139**	**27,009**	**5,522**	**3,571**	**6,931**
Reasonably Foreseeable Development for 2020								
North Gillette Subregion	121	21,311	9,529	4,766	7,013	1,019	935	505
South Gillette Subregion	148	42,981	25,016	8,758	9,206	1,444	1,018	2,072
Wright Subregion	307	84,797	51,651	21,021	12,124	3,215	2,279	4,354
Total for 2020	**576**	**149,089**	**86,196**	**34,545**	**28,345**	**5,678**	**4,232**	**6,931**

[1] Area Unavailable for reclamation includes disturbed areas occupied by permanent or long-term facilities such as buildings, roads, topsoil stockpiles, etc.
Source: PRB Coal Review Task 2 Report (BLM 2005a)

baseline year and cumulative projected disturbance areas are broken down into three categories:

- areas which are or projected to be permanently reclaimed;
- areas which are or projected to be undergoing active mining or which have been mined but are not yet reclaimed; and,
- areas which are or projected to be occupied by mine facilities, haul roads, stockpiles, and other long-term structures, and which are therefore unavailable for reclamation until mining operations are completed.

The two tables also include estimates of baseline year and projected future coal mining employment, water consumption, and water production.

The four LBA tracts in the general South Gillette analysis area are associated with each of the four currently operating mines in the South Gillette subregion of mines. Each operating mine has an LBA pending. The analysis assumes that if the LBAs are offered and if the applicant becomes the lessee, each mine will increase current production to a level where the four mines collectively will produce at an aggregate production level midway between the low and high projected coal production scenarios for 2015 and 2020 shown in figure 4-3 and tables 4-2 and 4-3. The coal development levels and associated disturbance shown in tables 4-2 and 4-3 include production at the four South Gillette Area mines during the baseline year (2003) and projected production at the mines for 2010, 2015, and 2020.

As discussed above, the projected development levels shown in tables 4-2 and 4-3 are based on projected demand and coal market forecasts, which are not affected by a decision to lease or not to lease the LBA tracts in the South Gillette Area. The reserves in the LBA tracts if offered, and if the applicants become the lessees, would add to the mine life of each of the South Gillette Area mines.

As discussed in sections 1.1 and 2.1, FCW estimates that there were 249.5 million tons of recoverable coal reserves on the existing Belle Ayr Mine at the end of 2007. In 2007, the mine produced approximately 26.6 million tons and the currently approved by Wyoming Department of Environmental Quality/Air Quality Division (WDEQ/AQD) air quality permit allows mining of up to 45 million tons of coal per year. If the mine produces at the estimated 29.0 million ton per year the remaining recoverable reserves would be depleted in less than 9 years (2016). If the mine increases production to the permitted level, the remaining recoverable reserves at the Belle Ayr Mine would be depleted in about 5.5 years (2013). FCW estimates that the Belle Ayr North LBA tract includes approximately 158.1 million tons of recoverable coal as applied for. Based on that estimate, acquisition of the Belle Ayr North LBA tract would increase the recoverable reserves at the Belle Ayr Mine by almost 30 percent. At the estimated future production level (29 mmtpy), mine life would be extended by over 5 years. However, if production levels increase to the currently permitted

level (45 mmtpy) or if WDEQ/AQD approves a higher annual rate of production, the coal would be recovered more quickly.

ALC estimates that there were 223.2 million tons of recoverable coal reserves on the existing Coal Creek Mine at the end of 2007. The Coal Creek mine resumed production in 2006 after a temporary shutdown, and produced approximately 10.2 million tons in 2007. The average estimated future production rate is 13.4 million tons per year (mmtpy) and the currently approved (by WDEQ/AQD) air quality permit allows mining of up to 50 million tons of coal per year. If the mine produces at the estimated 13.4 million ton per year the remaining recoverable reserves would be depleted in about 17 years (2023). If the mine increases production to the permitted level, the remaining recoverable reserves at the Coal Creek Mine would be depleted in about 4.5 years (2011). ALC estimates that the West Coal Creek LBA tract includes approximately 57.0 million tons of recoverable coal as applied for. Based on that estimate, acquisition of the West Coal Creek LBA tract would increase the recoverable reserves at the Coal Creek Mine by about 26 percent. At the estimated future production level (13.4 mmtpy), mine life would be extended by just over 4 years. However, if production levels increase to the currently permitted level (50 mmtpy) or if WDEQ/AQD approves a higher annual rate of production, the coal would be recovered more quickly.

CCC estimates that there were 600.3 million tons of recoverable coal reserves on the existing Caballo Mine at the end of 2007. In 2007, the mine produced approximately 31.2 million tons. The average estimated future production rate is 37.8 million tons per year and the currently approved (by WDEQ/AQD) air quality permit allows mining of up to 50 million tons of coal per year. If the mine produces at the estimated 37.8 million ton per year the remaining recoverable reserves would be depleted in about 16 years (2022). If the mine increases production to the permitted level, the remaining recoverable reserves at the Coal Creek Mine would be depleted in about 12 years (2018). CCC estimates that the Caballo West LBA tract includes approximately 81.8 million tons of recoverable coal as applied for. Based on that estimate, acquisition of the West Coal Creek LBA tract would increase the recoverable reserves at the Coal Creek Mine by about 14 percent. At the estimated future production level (37.8 mmtpy), mine life would be extended by just over 2 years. However, if production levels increase to the currently permitted level (50 mmtpy) or if WDEQ/AQD approves a higher annual rate of production, the coal would be recovered more quickly.

CMC estimates that there were 274.1 million tons of recoverable coal reserves on the existing Cordero Rojo Mine at the end of 2007. In 2007, the mine produced approximately 40.5 million tons. The average estimated future production rate is 46.3 million tons per year and the currently approved (by WDEQ/AQD) air quality permit allows mining of up to 65 million tons of coal per year. If the mine produces at the estimated 46.3 million ton per year the remaining recoverable reserves would be depleted in about 6 years (2013). If the mine increases production to the permitted level, the remaining recoverable reserves at the Cordero Rojo Mine would be depleted in about 4 years (2011). CMC estimates

that the Maysdorf II LBA tract includes approximately 434.3 million tons of recoverable coal as applied for. Based on that estimate, acquisition of the Maysdorf II LBA tract would increase the recoverable reserves at the Cordero Rojo Mine by about 160 percent. At the estimated future production level (46.3 mmtpy), mine life would be extended by just over 9 years. However, if production levels increase to the currently permitted level (65 mmtpy) or if WDEQ/AQD approves a higher annual rate of production, the coal would be recovered more quickly.

4.1.1.2 Coal-Related Development

Coal-related development as defined for this analysis includes railroads, coal-fired power plants, major (230-kV) transmission lines, and coal technology projects. Table 4-4 summarizes the estimated disturbance associated with coal-related development activities for the baseline year and the projected disturbance through 2020. The subsequent paragraphs summarize the existing coal-related development in the Wyoming PRB and the reasonably foreseeable development considered in the PRB Coal Review.

Table 4-4. Baseline Year and Projected Wyoming PRB Coal-Related Development Scenario.

	2003	**2010**	**2015**	**2020**
Coal-Related Disturbance (Acres)	4,891	4,966	5,911	5,911

Source: PRB Coal Review Task 2 Report (BLM 2005a)

4.1.1.2.1 Coal Transportation

As discussed above, electric utilities account for about 97 percent of Wyoming's coal sales. Most of the coal sold to electric utilities is transported to power plants by rail. A small part, about 2 percent in 2007, of national coal production is exported abroad, but data are not published as to where this export coal is produced. The coal mines in the Wright and South Gillette subregions are served by a joint Burlington Northern Santa Fe and Union Pacific (BNSF & UP) rail line. For the baseline year of 2003, the existing capacity of the line was estimated at approximately 350 mmtpy. For that same year, the existing capacity of the BNSF line, which services the North Gillette subregion, was estimated at 250 mmtpy. Expansion work was completed by 2008 that increased capacity to approximately 450 mmtpy, and plans have been announced to raise capacity to 500 mmtpy by 2012 (BNSF 2008, CANAC 2007).

The PRB Coal Review projected that two coal transportation projects would be developed prior to 2020 in Wyoming: expansion of the BNSF & UP rail facilities south of Gillette and the construction of the Dakota, Minnesota & Eastern Railroad Corporation (DM&E) rail line in Wyoming and South Dakota. A third project proposed by the Tongue River Rail Company would be built between Decker and Miles City Montana.

BNSF and UP have completed work to improve sections of the existing joint UP/BNSF rail line and had increased capacity from 350 mmtpy to 450 mmtpy by 2008 with plans to improve additional sections of the existing joint rail line and to further increase capacity to 500 mmtpy by 2012. This work includes construction of third and fourth main line track segments where needed. The increased capacity would accommodate the projected upper and lower production rates at the southern mines, which are projected to produce 439 mmtpy and 455 mmtpy by 2020. The remaining planned expansion projects are considered highly likely to occur.

The proposed DM&E rail line would include new rail construction in South Dakota and Wyoming (approximately 15 and 265 miles, respectively) and 600 miles of rail line rehabilitation in South Dakota and Minnesota. Approximately 78 miles of the new rail construction would occur in the PRB study area, where the project would provide new rail spur services to the mines in the South Gillette and Wright subregions. The Surface Transportation Board (STB) released a final supplemental EIS for this project on December 30, 2005 and granted final approval to construct the rail line on February 15, 2006. The supplemental EIS, which addressed issues that were successfully appealed after an EIS was completed in 2001, was also appealed. The supplemental EIS was upheld by the US Court of Appeals for the Eighth Circuit in December 2006. In 2007, Canadian Pacific Railway (CP) acquired DM&E and plans to integrate DM&E's operations into Canadian Pacific Railway's operations as soon as STB approval is received, which occurred on September 30, 2008 (STB 2008). The expansion into the PRB would require a substantial financial commitment and CP is concentrating on the acquisition of DM&E before making a decision on the expansion project.

The STB recently announced approval of the final stretch of the rail line proposed by the Tongue River Railroad Company. The company must acquire necessary federal and state permits and ROWs through private and public property before constructing the line. If it is constructed, it would provide a shorter route for some of the mines in the North Gillette subregion, which ship coal on the existing BNSF rail line (Billings Gazette 2007a).

For the purposes of the PRB Coal Review, it was projected that the DM&E line would be constructed when the total rail haulage requirement from the eastern Wyoming PRB reaches 450 to 500 million tons per year and would potentially be operational by 2015. The construction of this rail line is considered moderately likely to occur. The PRB Coal Review assigned a low likelihood of development by 2010 under the upper coal production scenario, and projected the construction of the Tongue River Railroad Company line would not occur unless the Otter Creek Mine is developed. In 2007, a request was submitted to lease two tracts of state coal at Otter Creek (Billings Gazette 2007b). In July of 2008 the Montana Department of Natural Resources and Conservation (DNRC) initiated an appraisal of the Otter Creek lease tracts. The tracts may be offered for lease in 2009.

4.1.1.2.2 Electric Power Generation

Currently, there are five coal-fired power plants in the Wyoming PRB study area for Tasks 1 and 2 (figure 4-1). Black Hills Power Corporation owns and operates the Neal Simpson Units 1 and 2 (21.7-MW and 80-MW, respectively), Wygen I and II (80-MW and 95-MW, respectively), and Wyodak (330-MW) power plants, all of which are located approximately five miles east of Gillette, Wyoming. Pacific Power and Light's Dave Johnston Power Plant is located near Glenrock, Wyoming, outside of but adjacent to the study area.

There are also three separate interconnected gas-fired power plants (Hartzog, Arvada, and Barber Creek) located near Gillette, Wyoming (figure 4-1). Each contains three separate 5-MW-rated turbines that provide electric power to Basin Electric and its customers. In winter, the maximum capacity can reach 22.6-MW from each site. All units are in operating condition, although they do not operate at maximum capacity.

Several additional power plants are projected to be built prior to 2020. The PRB Coal Review assumed that proposed coal-fired power plants that plan to initiate operation by 2010 would have to have been undergoing air permit review by 2003 in order to obtain the required construction permits and complete construction by 2010. The following two identified projects are considered likely for development by 2010:

- North American Power Group has permitted a coal-fired power plant (Two Elk Unit 1) at a 40-acre site located approximately 15 miles southeast of Wright, Wyoming. As originally permitted, the project also would include installation of a gas-fired turbine. The unit would be dry-cooled, requiring very little water. The state has approved several hundred million dollars in tax-exempt bonds for the power plant and North American Power Group is completing financing for the remaining cost of the plant. The company recently announced that it has signed a transmissions agreement with Pacificorp and is planning to have the 320-MW plant in operation by October 2011 (Gillette News-Record 2007b, 2007c). The air permit originally was issued in August 2002, then revoked temporarily and restored by DEQ in 2007. In 2008, the Wyoming Environmental Quality Council (WEQC) denied a request by the Sierra Club for a new hearing on the air quality permit allowing construction of the facility. The Sierra Club filed a law suit in District Court in Cheyenne to reverse the DEQ decision (Gillette News-Record 2008a).

- Basin Electric Power Cooperative obtained permits from the Wyoming Industrial Siting Council in June, 2006, and WDEQ/AQD in October, 2007, to construct and operate the Dry Fork Station Power Plant. As proposed, the Dry Fork Station would be a coal-based, mine-mouth 385-MW power plant located near the Dry Fork Mine, north of Gillette, Wyoming. The issuance of the air permit allowed construction to start at the Dry Fork Station. Construction on the plant started in November,

2007. In late October, 2007, several environmental groups filed an appeal of the air permit issued by WDEQ. The WEQC denied requests to suspend construction. After due process, on November 20, 2008 the WEQC approved orders to dismiss the issues before it and terminated the appeal. The orders were signed on December 12, 2008. The environmental groups announced intent to appeal in Wyoming District Court. Basin Electric estimates that the plant will be operational by 2011 (WDEQ/ISD 2007). At the time of the PRB Coal Review study it was estimated that 1.2 million tons of coal per year would be required to fuel the facility. Construction and operation of this facility as scheduled is considered moderately likely.

The PRB Coal Review assumes that, under the upper coal production scenario, a maximum of one additional 700-MW coal-fired power plant would be constructed by 2020 in the Gillette area or near one or more of the operating coal mines. North American Power Group (NAPG) submitted an application in September 2007 for a 750-MW coal-fired power plant, Two Elk 2, to be located at the same site as the proposed Two Elk plant, which is discussed above. Black Hills Power Corporation has also announced plans to construct the Wygen III power plant, sized at 100-MW, which is planned to be similar in design to the Wygen II plant. As of November 2008 the project was on schedule. The air permit for this facility was issued in March 2007 with construction started in 2008. (SourceWatch 2007) The study assumes that all existing power plants in the PRB region would remain operational through 2020.

4.1.1.2.3 Transmission Lines

Major transmission lines in the Wyoming PRB study area that support the regional distribution system are associated with the Dave Johnston power plant located near Glenrock, Wyoming, and the power plants operated by Black Hills Power Corporation, which are located east of Gillette. These 230-kV transmission lines have been in place for several years, and their associated permanent disturbance is minimal. Distribution power lines associated with conventional oil and gas and coal bed natural gas (CBNG) development also occur within the study area. For the PRB Coal Review, these lines were included by factoring them in proportionally on a per well basis.

The PRB Coal Review estimated that by 2020, four major transmission lines would be constructed. Markets would dictate the size and location of such facilities, and these are not known as of this time. Because transmission lines are a necessary supporting infrastructure for power generating facilities to provide connection to the grid, the PRB Coal Review assumes they would be required as part of the overall system development for the proposed power plants discussed in the previous section. Six specific proposals for these transmission lines have been identified. There is currently insufficient information to analyze or assign likelihood of development by 2020.

The governors of California, Nevada, Utah, and Wyoming entered into a Memorandum of Understanding to encourage development of a high voltage

power transmission line, the Frontier Line, connecting those states in April, 2005. Since that time, no specific plans have been announced as to the location or timing of the Frontier Line. The 345KV Wyoming-Colorado Intertie, as well as the Trans West and Gateway West and South projects have been proposed in Wyoming, in order to move power from Wyoming to growing Idaho and Nevada and other western U.S. load demand areas (Casper Star Tribune 2007b). The TransWestern Express proposes to move electric power from Wyoming to Arizona through Colorado or Utah. The High Plains Express is proposed to move power from Wyoming to New Mexico and Arizona.

4.1.1.2.4 Coal Conversion Technology

With rising energy prices, there has been considerable interest in either enhancing the quality of PRB coal and/or converting the coal to other fuels. Test facilities were previously constructed by KFx at the Fort Union Mine (now part of the Dry Fork Mine), by AMAX (predecessor to Foundation Coal West, Inc.) at the Belle Ayr Mine, and by ENCOAL at the Buckskin Mine, but no commercial production occurred and these facilities have either been dismantled or are no longer in use. Although several coal conversion projects have been proposed, as discussed below, only one (the KFx Coal Beneficiation Project) was considered to have a high enough likelihood of proceeding to include it in the PRB Coal Review, based on its status and available information.

The KFx (now Evergreen Energy) coal beneficiation plant, located near the Dry Fork Mine, north of Gillette, was operational but did not reach full capacity. KFx reported making its first production run and shipping coal to two customers for test burns in late December, 2005. In August, 2006, KFx reported that a trainload of enhanced coal had been loaded and sent to a customer in Ohio. Commercially viable product was produced through 2007 until the plant was idled down in 2008. It was predicted that the plant would eventually produce approximately 750,000 tons of enhanced coal per year. This operation had a high likelihood of proceeding with production given the technology being used and the forecast market conditions in the PRB. Evergreen Energy Inc. and its strategic partner, Bechtel Power Cooperation, have decided to relocate operation to a different location with a greater market and will improve the plant design (Evergreen Energy Inc. 2009). The company has suggested that up to five additional units will be built, some perhaps in the PRB, but the likelihood for development of additional units is not known. As a result, the potential development of additional units was not analyzed in the PRB Coal Review.

The following coal conversion projects have been proposed, but were not included in the PRB Coal Review analysis because the likelihood of their occurrence was not known when the coal review analysis was conducted:

- Medicine Bow Fuel and Power, a subsidiary of DKRW Advanced Fuels, LLC, has announced that it plans to build a coal-to-liquids plant with an in-service year of 2013 in northern Carbon County, Wyoming. GE Energy and Rentech Clean Energy Solutions are also involved in the project,

which would obtain coal from Saddleback Hills Mine facility. Both the plant and mine are located outside of the PRB. The primary product would be ultra-low-sulfur diesel fuel produced from sub-bituminous coal. The company is in the process of permitting the plant and expects to begin initial site work in 2010, with completion planned for 2011 (Casper Star Tribune 2007c, DKRW 2009).

- Coal gasification development projects are being actively pursued by several groups, including the Wyoming Business Council, Campbell County Economic Development Corporation (CCEDC), and Converse Area New Development Organization (CANDO). Specifically, CANDO is pursuing the development of coal gasification leading to production of pure hydrogen with carbon dioxide (CO_2) as a by-product within 5 to 8 years. While there appears to be substantial interest in these opportunities, it is unknown whether large-scale operations would be developed within the 2010 to 2020 timeframe, given permitting, engineering, and construction time requirements. When the PRB Coal Review was prepared, a project proponent with adequate financing to pursue a project that would utilize PRB coal had not been identified, and one has not been identified since.

A summary of past, present, and reasonably foreseeable coal mines, coal-related facilities, coal production, coal mine employment, and coal and coal-related disturbance in the Wyoming PRB is presented in table 4-5.

4.1.2 Oil and Gas Development

The following information on existing conventional and CBNG development is summarized from the PRB Coal Review Task 2 Report (BLM 2005a). The information reported is for 2003, which was the baseline year for the coal review.

4.1.2.1 Conventional Oil and Gas

Conventional oil and gas development includes all non-CBNG development activity. Approximately 1,500 conventional oil and gas wells, including producing, non-producing and injection wells, were drilled between 1990 and 2003 (IHS 2004) in the PRB Coal Review Task 2 Study Area. Of those, 60 percent were development wells, drilled in established producing areas. The remaining 40 percent were classified as wildcat wells, which are wells that are drilled in non-producing areas or drilled to evaluate untested prospective zones in producing areas. Approximately 75 percent of the wildcat wells were plugged and abandoned. By 2003, the successful new field wildcat wells had resulted in the discovery of 61 new fields that produced 719,000 barrels of oil and 1.45 billion cubic feet (bcf) of non-CBNG (WOGCC 2004).

As of the end of 2003, there were approximately 3,500 producing conventional oil and gas wells in the Wyoming PRB study area plus 1,386 seasonally active wells (IHS 2004). The Wyoming Oil and Gas Conservation Commission

Table 4-5. Past, Present, and Projected Wyoming PRB Coal Mine and Coal-Related Development Scenario.

Year	Coal Production (mmtpy)	Number of Active Coal Mines[1]	Number of Active Power Plants	Number of Active Coal Conversion Facilities[2]	Direct Coal Mine Employment	Total Coal Disturbance (acres)[3]
Past and Present						
1990	163	18	3	1	2,862	na
1995	247	19	4	1	3,177	na
2000	323	12	4	2	3,335	na
2003	363	12	4	0	5,010	73,685
Projected Development - Lower Coal Production Scenario						
2010	411	13[1]	7	1[2]	5,263	103,628
2015	467	13[1]	7	1[2]	5,405	123,147
2020	495	13[1]	7	1[2]	5,531	143,354
Projected Development - Upper Coal Production Scenario						
2010	479	13[1]	7	1[2]	5,339	107,414
2015	543	13[1]	7	1[2]	5,522	130,456
2020	576	13[1]	8	1[2]	5,678	155,000

[1] Mines have consolidated and may in the future. Also, new mines may be permitted to better access the coal reserves projected for mining by 2020.
[2] Several coal conversion facilities currently are being evaluated; however, there is only one for which the likelihood of future development currently can be assessed.
[3] Disturbance area includes coal mine and coal-related disturbance areas.
Source: Annual Report of the Wyoming State Mine Inspector (Wyoming Department of Employment 1990, 1995, 2000, and 2003) and PRB Coal Review Task 2 Report (BLM 2005a)

(WOGCC) reported that these wells produced approximately 13 million barrels of oil and 40 bcf of conventional gas in 2003 (WOGCC 2004). The U.S. Geological Survey (USGS) estimated that the mean undiscovered non-coal bed hydrocarbon resource in the PRB (including Montana) is 1.8 billion barrels of oil equivalent (BOE) (USGS 2002a).

Most of Wyoming's current oil production is from old oil fields with declining production and the level of exploration drilling to discover new fields has been low (WSGS 2002). This situation is reflected in the PRB where, over the 10-year period from 1992 through 2002, oil production from conventional oil and gas wells in Campbell and Converse Counties decreased approximately 60.4 percent (from 32.8 million barrels in 1992 to 13.0 million barrels in 2002). Oil prices have been increasing, which is reversing projections of a continuing decline in oil and gas production; production is now expected to increase in the PRB, with a peak around 2010 of approximately 15.7 million barrels (WSO-RMG 2005). Oil production in the short term may also be bolstered by some planned CO_2 flood projects in the PRB (WSGS 2003). This projected temporary upward trend in conventional oil and gas development is reflected in the PRB Coal Review projections (table 4-6).

The active wells identified in table 4-6 include wells that produce year-round, seasonally producing wells, and service wells (mainly injection wells.) It is estimated that there are approximately 2,000 idle conventional oil and gas wells

Table 4-6. Baseline Year and Projected Wyoming PRB Conventional Oil and Gas Development Scenario.

Category	Existing: 2003 Task 1 Study Area	Existing: 2003 Task 3 Study Area	Projected for Task 3 Study Area: 2010	2015	2020
Annual Gas Production (bcf)[1]	39.9	36.3	33.8	30.9	28.0
Annual Oil Production (mmbo)	12.9	11.4	13.8	12.5	11.2
Active and Seasonably Active Wells	5,067	3,890	5,603	5,115	4,625

[1] Future gas production per well was estimated based on 2003 production levels per subwatershed. A greater number of future well sites were assumed to occur in locations with historically lower production rates, so the projected future conventional gas production varies within the cumulative effects study area relative to the number of projected producing wells.

Source: PRB Coal Review Task 2 Report (BLM 2005a)

in the PRB study area (WOGCC 2005b); however, the number of idle wells gradually would be reduced in the future through plugging programs, and the idle well locations (once the wells are abandoned) would be reclaimed and no longer represent a disturbance.

4.1.2.2 CBNG Development

Natural gas production has been increasing in Wyoming. In the PRB, this is due to the development of shallow CBNG resources. Commercial development of these resources began in limited areas west of and adjacent to the northernmost surface coal mines in the late 1980s. Since that time, CBNG development has spread south and west into other parts of the PRB Coal Review Task 1 and Task 2 study area.

On private and state oil and gas leases, the WOGCC and the Wyoming State Engineer's Office (SEO) authorize CBNG drilling. On federal oil and gas leases, BLM must analyze the individual and cumulative environmental impacts of all drilling (federal, state, and private), as required by NEPA, before CBNG drilling can be authorized. BLM does not authorize drilling on state or private leases but must consider the impacts from those wells in their NEPA analyses. In many areas of the PRB, the coal estate is federally owned, but the oil and gas estate is privately owned. A June 7, 1999 Supreme Court decision (98-830) assigned the rights to develop CBNG on a piece of land to the owner of the oil and gas estate.

Annual CBNG production increased rapidly in the PRB between 1999 and 2003 but has leveled off somewhat since then. At the end of 2003, there were 14,758 producing CBNG wells in the study area (IHS 2004), and total production for 2003 was 346 bcf, or 88 percent of the total gas production from the basin (WOGCC 2004). Total production for 2006 was 377 bcf (WOGCC 2007b). Average daily CBNG production was 900 million cubic feet of gas per day

(mmcfpd) in 2003 (Holcomb 2003) and it is estimated that it will average 1,150 mmcfpd (1.15 bcfpd) for 2007 (WOGCC 2007b). From 1987 to 2003, the total cumulative gas production from PRB coals was over 1.2 trillion cubic feet. The total water production for the same time period was approximately 2.3 billion barrels (96,600 million gallons). Water production in 2003 amounted to more than 500 million barrels (21,000 million gallons), or about 1.4 million barrels per day. According to the WOGCC website, water production in the PRB associated with CBNG production has varied between just over 1.4 million barrels per day and about 2.2 million barrels per day since December 2003.

Since the early 1990s, the Wyoming BLM has completed numerous environmental assessments (EAs) and two EISs analyzing CBNG projects. The most recent of these is the four-volume Final EIS and Proposed Plan Amendment for the PRB Oil and Gas Project, which was completed in January 2003 (BLM 2003). The level of CBNG development since 2003 appears to be lower than was forecast in that document. New CBNG well numbers fell from a high of slightly more than 4,600 in 2001 to approximately 2,000 in 2004. The PRB Coal Review Task 2 Report discusses the uncertain trends for future CBNG activity in recent years. The methodology used to project future activity is detailed in Appendix E of that report. Table 4-7 shows the 2003 and projected 2010, 2015, and 2020 levels of CBNG development levels used to evaluate projected cumulative environmental impacts in the PRB Coal Review.

Table 4-7. Baseline Year and Projected CBNG Development Scenario for the Wyoming PRB.

	Existing		Projected to Task 3 Study Area		
Category	**2003 Task 1 Study Area**	**2003 Task 3 Study Area**	**2010**	**2015**	**2020**
Annual Production (bcf)	338	284	480	500	443
Active Wells	14,758	12,152	20,899	21,831	19,366

Source: PRB Coal Review Task 2 Report (BLM 2005a)

4.1.2.3 Oil and Gas Related Development

Oil and gas related development activities considered in the PRB Coal Review include major transportation pipelines and refineries. Table 4-8 summarizes the net disturbance, reclamation, and water production associated with oil and gas activity (conventional oil and gas, CBNG, and major transportation pipelines) for 2003 (baseline year) and projects disturbance, reclamation, and water production for future years.

4.1.2.3.1 Pipelines

The availability of pipeline capacity for the transport of oil and gas to outside markets is a key factor in the development of CBNG and conventional oil and gas resources in the Wyoming PRB. In 2003, the baseline year for the PRB coal Review, there were 13 major transportation pipeline systems in the PRB that

Table 4-8. Wyoming PRB Conventional Oil and Gas, CBNG, and Related Development Disturbance and Water Production.

Category	Existing[1] 2003 Task 1 Study Area	2003 Task 3 Study Area	Projected for Task 3 Study Area[1] 2010	2015	2020
Cumulative Disturbed Area (Acres)[2]	187,761	148,602	237,883	304,543	361,331
Cumulative Permanently Reclaimed Area (Acres)	115,045	90,548	160,175	225,426	288,536
Cumulative Unreclaimed Area (Acres)	72,715	58,053	77,707	79,108	72,794
Annual Water Production (mmgpy)	26,405	21,204	39,108	41,484	37,350

[1] Minor discrepancies in total acreages are the result of number rounding.
[2] Inclusive of conventional oil and gas and CBNG activities and major transportation pipelines. Disturbance associated with ancillary facilities (including gathering lines and distribution power lines has been factored in a per well basis.
Source: PRB Coal Review Task 2 Report (BLM 2005a)

transport gas resources to markets outside of the basin (Flores et al. 2001). The 2003 capacity of these pipeline systems was 1.9 bcf per day. The combined natural gas production (CBNG and conventional gas) in the Wyoming PRB Coal Review Task 1 and Task 2 study area was approximately 1.03 bcf per day.

Major transportation pipelines also provide for transport of CO_2 to conventional oil fields for enhanced oil recovery (EOR). Increased recovery of crude oil also may depend somewhat on the availability of CO_2 for EOR projects, as well as the availability of pipelines to transport oil to refineries for processing.

Gathering lines and power lines associated with conventional oil and gas and CBNG development also occur within the study area; disturbance from these ancillary facilities were factored into the PRB Coal Review analysis on a per well basis.

A 315-mile-long pipeline project, the Bison Pipeline Project, was originally proposed in 2004 to move natural gas northward, directly out of the PRB and into the Northern Border Pipeline system. Approximately 53 miles of the proposed route is within the Wyoming PRB Coal Review study area. If it is constructed, it would have a 240 mmcfpd capacity as proposed. The Federal Energy Regulatory Commission (FERC) received an application for the 302-mile Bison project proposal in April 2009 (FERC 2009).

The following two proposed pipeline projects in the PRB were listed on the Wyoming Pipeline Authority webpage (http://www.wyopipeline.com) as of

October 2007: MDU Resources Group, Inc. Williston Basin Interstate Pipeline 'Grasslands Pipeline' Expansion and ONEOK Cantera Gas Holdings Fort Union Gas Gathering Expansion. These are both expansion projects which involve adding capacity to an existing pipeline. Information on pipeline projects proposed in Wyoming can also be found in the "For Citizens" section of the Federal Energy Regulatory Commission website at http://www.ferc.gov.

The amount of available pipeline capacity could limit the amount of future CBNG development. In 2003, it was estimated that growth of Wyoming PRB CBNG production could rise from the 2003 level of 900 mmcfpd up to 3 to 4 bcf per day around 2007 and remain at or above those levels until 2015 (Holcomb 2003). If CBNG production levels reach 3 to 4 bcf per day, it is reasonable to assume that several pipeline projects with up to 1.0 bcf per day capacity each could be built in the PRB. However, as discussed previously, the actual average production for 2007 is currently projected to be 1.15 bcfpd and, based on the assumptions in Appendix E of the PRB Coal Review Task 2 Report, the basin-wide CBNG production is projected to reach approximately 1.7 bcf per day in 2020. New pipeline construction projects were not considered in the PRB Coal Review analysis because the likelihood for additional new pipeline construction was unknown when the PRB Coal Review was prepared.

The CO_2 pipeline from Bairoil, Wyoming, to Salt Creek, Wyoming, may be extended into the PRB Coal Review study area to the Sussex Field to support additional EOR activity. Although it took many years for a CO_2 source to reach the Wyoming PRB, it is very likely that several pipelines could be built in the study area in the near future to provide additional gas for EOR projects. However, no pipeline projects were identified that would transport CO_2 beyond Salt Creek and the likelihood for construction of additional CO_2 pipelines was unknown when the PRB Coal Review analysis was prepared, and they were not considered.

4.1.2.3.2 Refineries

Construction of a new refinery was completed in the Wyoming PRB study area in 2008. The NorthCut Refinery, owned and operated by Interline Resources, is located in Converse County, approximately 20 miles north of the town of Douglas, Wyoming. Construction of the refinery, which was a conversion of the previously existing Well Draw Gas Plant, included installation of a crude oil pipeline between the company's existing crude gathering system and the refinery.

The NorthCut Refinery is a crude oil topping plant, specifically engineered to process 4,000 barrels per day of sweet crude produced in the PRB. Output from the refinery will include naptha, off-road diesel, and reduced crude oil. The markets for the products include ethanol manufacturers, mines, and other refineries. The company-owned crude oil pipeline and third-party tanker trucks will be used for delivery of crude stocks. Tanker trucks also will be used to transport finished products from the facility (Interline Resources 2008).

The refinery is adjacent to and east of SH 59, with the joint UP/BNSF rail line located just to the west of the highway. The site previously had been the location of the Well Draw Gas Plant (approximately 20 acres), which shut down in 2002 following a fire. Interline has acquired an additional 12 acres bordering the original site for administrative, maintenance, and transportation-related uses (Interline Resources 2008).

The level and composition of outputs from the existing NorthCut Refinery would respond to various markets, potentially resulting in the construction of additional infrastructure and/or facilities in the future. Any future changes and associated disturbances would occur within the property currently owned by Interline Resources at the NorthCut site (Williams 2008). No specific plans for expansion currently have been identified. As a result, the likelihood for project expansion currently is considered speculative. Therefore, it has been eliminated from further analysis in this study.

No other reasonably foreseeable plans for construction and operation of new petroleum refineries in the Wyoming portion of the PRB have been identified.

4.1.3 Other Development Activity

4.1.3.1 Other Mining

Uranium, sand, gravel, bentonite, and clinker (or scoria) have been and are being mined in the Wyoming PRB study area.

There are three defined uranium districts in the PRB: Pumpkin Buttes, Southern Powder River, and Kaycee (BLM 2003). Numerous mined out or uneconomic uranium mining sites are present in these districts. Uranium is currently produced in the Southern Powder River District using the in-situ leach method. There is one operating in-situ uranium recovery site in the PRB, the Smith Ranch-Highland Mine in Converse County, but the recent increase in interest in uranium for power plants here and abroad is generating interest in new development in the PRB. According to the U.S. Nuclear Regulatory Commission website (http://www.nrc.gov), interest has been expressed in restarting in-situ operations at the Christianson Ranch Site in Johnson County, Wyoming, and an application has been received from Energy Metals Corporation to construct and operate an in-situ uranium recovery facility at Moore Ranch in Campbell County, Wyoming. Based on commodity forecasts and uranium activity as of June 2004, the likelihood and potential timing of new uranium mining operations in the PRB was not known, and additional development was not projected in the PRB Coal Review analysis.

In the original Task 2 report (BLM 2005a), reasonably foreseeable uranium development was eliminated from further consideration because: 1) there were no specific projects with pending applications and 2) no development was anticipated, based on market conditions. Due to increased overall demand for energy in recent years, uranium prices have increased from a low of $7.00 a

pound in 2001 to over $138 a pound in 2007 (Barry 2008). The price fell precipitously after that, but appears to be stabilizing at approximately $75 per pound.

In response to the increased price of uranium, a number of uranium mine developments currently are proposed in the Wyoming PRB study area (table 4-9). These include seven new proposed developments, two proposed expansions, and one proposed restart, all of which would use in situ recovery. Most of the proposed developments are in the Pumpkin Buttes uranium district in southwestern Campbell County. The actual number of the proposed developments that would become operational would depend on several factors including price and approval of permits.

Bentonite is weathered volcanic ash that is used in a variety of products, including drilling mud and kitty litter, because of its absorbent properties. There are three major bentonite producing districts in and around the PRB: the Colony District in the Northern Black Hills, the Clay Spur District in the Southern Black Hills, and the Kaycee District west of Kaycee, Wyoming. Within the PRB Coal Review study area, bentonite is mined at Kaycee (WMA 2006). The PRB Coal Review assumed that bentonite mining would continue throughout the study period and that production would continue at existing active mines, with no new mines developed through 2020.

Aggregate, which is sand, gravel, and stone, is used for construction purposes. In the PRB, the more important aggregate mining localities are in Johnson and Sheridan Counties (WSGS 2004). The largest identified aggregate operation is located in northern Converse County. It has an associated total disturbance area of approximately 67 acres, of which four acres have been reclaimed.

Scoria or clinker (which is formed when coal beds burn and the adjacent rocks become baked) is used as aggregate where alluvial terrace gravel or in-place granite/igneous rock is not available. Scoria generally is mined in the Converse and Campbell Counties portion of the Wyoming PRB study area.

Increased sand, gravel, and scoria production and associated surface disturbance are anticipated in the Wyoming PRB study area in the future because aggregate would be required for road maintenance and new construction activities as other primary resources, such as coal and oil and gas, continue to be developed. New operations and increased production from existing operations can be expected. These operations would vary in size based on the immediate need from the primary industries, but there is no specific information about these projected operations. As a result, new sand, gravel, or scoria operations were not analyzed in detail in the PRB Coal Review.

4.1.3.2 Industrial Manufacturing

There are a number of existing industrial manufacturing establishments located in the Wyoming PRB Coal Review study area. Most are relatively small with

Table 4-9. U.S. Nuclear Resources Commission Applications for In-Situ Recovery Uranium Projects in the Wyoming PRB Study Area.

Project/ Company	Location	Type Application	Watershed/Mining District	Likelihood/ Rationale
Moore Ranch/Uranium One (formerly Energy Metals Corporation)	T41-42N, R74-75W; Campbell and Converse counties.	New	Antelope Creek, Upper Powder River/Pumpkin Buttes District	Moderate for 2010. Application filed with U.S. Nuclear Regulatory Commission (USNRC) October 2007.
Nichols Ranch-Hank Unit/ Uranerz	Nichols Ranch: T43N, R76W; Campbell and Johnson counties. Hank Unit: T43-44N, R75W; Campbell County.	New	Upper Powder River/Pumpkin Buttes District	Moderate for 2010. Applications filed with USNRC and WDEQ.
Christensen Ranch/Cogema	T44N, R76W; Johnson County.	Restart	Upper Powder River/Pumpkin Buttes District	Moderate for 2010. USNRC application pending, received April 2007.
Smith Ranch/Cameco (Power Resources)	T36N, R74W; Converse County.	Expansion	Middle North Platte River/South Powder	Moderate for 2015. Expansion of existing facility, letter of intent March 2008, application expected 2009.
North Butte/Cameco	T44N, R76W; Campbell County.	Expansion	Upper Powder River/Pumpkin Buttes District	Moderate for 2015. Letter of intent to USNRC March 2008, application expected 2009.
Collins Draw/Uranerz	T42N, T43N, R76W; Campbell County.	New	Upper Powder River/Pumpkin Buttes District	Moderate for 2015. Letter of intent to USNRC March 2008, application expected 2009.
Ludeman-Allemand-Ross/Uranium One	Converse County	New	Antelope Creek	Moderate for 2015. Letter of intent to USNRC March 2008, application expected 2009.
Ruby Ranch/Cameco	T43N, R75W; Campbell County.	New	Upper Belle Fourche River/Pumpkin Buttes District	Moderate for 2015. Letter of intent to USNRC March 2008, application expected 2009.
Reno Creek/ Strathmore Minerals Corporation	T43N, R73; Campbell County.	New	Upper Belle Fourche River, Antelope Creek/Pumpkin Buttes District	Moderate for 2015. Letter of intent to USNRC March 2008, application expected 2010.
Southwest Reno Creek/ Strathmore Minerals Corporation	T42-43N, R73-74W	New	Antelope Creek/Pumpkin Buttes District	Speculative. No information on applications available.

Sources: Strathmore Minerals Corporation (2008), USNRC (2008a, 2008b, 2008c); World Information Service on Energy (2007)

fewer than 25 employees; they predominately serve regional and local markets, and most are directly or indirectly related to energy resource development and production. Over the years, some of these firms have expanded such that they now support activities and serve markets outside of the region, but those operations remain dependent upon the local and regional markets to sustain their existing operations.

The PRB Coal Review anticipates that increased coal production would result in an increased demand for fuels and explosives. This increased demand could result in the need for the development of new off-site chemical feedstock plants in the study area. Project-specific information is not available, however, and the potential development of new chemical feedstock plants was not considered in the PRB Coal Review.

Local economic development organizations, including CCEDC and CANDO, are continually engaged in efforts to recruit or assist new business formation in the PRB study area. For example, CANDO has pursued development of long-term potential projects; however, the outcomes of those projects are uncertain and little information and detail are available. As a result, they were not considered in the PRB Coal Review.

4.1.3.3 Wind Power

Wind power facilities have been proposed at various sites in Wyoming, including the Powder River Basin region. There is potential in the Wyoming sites for wind power, and these facilities can contribute to meeting forecasted electric power demands, however they are dependent on available transmission capacity to send power to users. The transmission capability is a constraining factor (Gillette News-Record 2008b). Wyoming ranks in seventh place in terms of wind energy potential with a current production in 14th place with 459 megawatts. Although many Wyoming locations having the highest potential are in the southern portion of the state, areas in both Converse and Campbell counties offer sufficient potential to support commercial-scale wind generation projects.

- One such project currently is under development in the Wyoming PRB study area, and another is in the planning stages. PacifiCorp is constructing a three-phase project in Converse County, approximately 15 miles north of the existing Dave Johnston Power Plant, on and near the site of the former Dave Johnson Mine. The first two phases, known as the Glenrock Wind Energy Project and the Rolling Hills Wind Energy Project, are scheduled for completion in 2008. The third, currently unnamed phase is anticipated to be constructed between 2009 and 2011, depending on market demands and the performance of the first two phases. Each phase would consist of 66 wind turbine generators (each rated at 1.5 MW [99-MW total]) mounted on 80-meter-tall tubular towers, plus ancillary support facilities (PacifiCorp 2007). This project is considered highly likely.
- Third Planet Windpower is in the initial development phase of a wind generating project in the Pumpkin Buttes area of southwestern Campbell

County. Third Planet Windpower has acquired 13,000 acres of land leases for the project, installed meteorological towers on site, and is currently doing environmental and feasibility studies. Contingent upon the meteorological data and other results, the company could install up to 167, 1.5-MW towers, yielding a total capacity of 250 MW, if fully constructed (Gartrell 2008). The site for the Reno Junction wind farm is close to the Black Hills Power substation and the companies are seeking an agreement for interconnection. Third Planet Windpower plans to start construction in June of 2010 with an online date in the end of 2010.

- Duke Energy's Campbell Hill Windpower Project is in the final site permitting stage, with construction anticipated to start in early 2009. The Campbell Hill Wind Power Project is to be located approximately 15 miles northeast of Casper, WY and will consist of 66 wind turbines generating 99 Megawatts per year. The facility is scheduled to come online in late 2009.
- Chevron Global Power Company is in the site planning stages of a wind energy project north of Evansville, WY, at the site of the Old Texaco Refinery currently owned by Chevron. The project plans for 13 turbines generating 20 megawatts of power. There is no projected online date at this time although Chevron Global Gas – Global Power is seeking to hire the Wind Farm Operations and Maintenance Manager.

4.1.3.4 Solar Power

Although Wyoming has been given a rating of very good for Annual Solar Potential for Flat Plate Collectors, there currently are no utility scale solar power collection facilities on federal, state, or privet lands in the state of Wyoming. Furthermore, no applications for the development of utility scale solar energy projects have been filed as of January 1, 2009.

The BLM and the U.S. Department of Energy (USDOE) are jointly preparing a solar energy programmatic environmental impact statement (PEIS) which could facilitate future solar energy development application processes. Wyoming is not covered in the PEIS but still may be affected by it. Information on the PEIS can be found at: http://solareis.anl.gov. The BLM currently evaluates solar energy project proposals on a case by case basis.

Solar energy utilization in Wyoming is, as of January 1, 2009, limited to private residences and private commercial establishments. Current Wyoming solar energy incentives include a sales tax rebate on industrial or commercial solar energy generation equipment, a one time grant of up to $3000 offered thru lottery from the Wyoming Business Council, and the utility buy back of unused electricity at the wholesale price. Solar energy production equipment and installation at residential, commercial, and utility sites is expensive. Currently, the electric utility costs in Wyoming are such that, the cost of installation does not favor solar energy development over existing forms of energy development.

4.1.3.5 Reservoirs

Currently, there are five key water storage reservoirs in the Wyoming PRB Coal Review study area (Healy, Lake DeSmet, Muddy Guard No. 2, Gillette, and Betty No. 1) (HKM Engineering et al. 2002a and 2002b). The total disturbance associated with these five key water storage areas is 3,263 acres.

Based on the applicable water plans prepared for the Wyoming Water Development Commission for its Basin Planning Program (HKM Engineering et al. 2002a and 2002b), there are long range projections for development of additional reservoirs in the Wyoming PRB study area. However, none of these reservoirs have reached the planning stage; therefore, there was not enough information to analyze them in the PRB Coal Review.

4.1.3.6 Other Non-Energy Development

In addition to the specific projects and developments described above, a network of public and private physical infrastructure, private enterprises, and public activities has been developed in the PRB over time. Examples of infrastructure include the highway and road networks, airports, government offices, hospitals, public schools, municipal water systems, and extensive residential and commercial real estate development. Private enterprises include local retail and service establishments, newspaper publishing, and transportation and distribution firms.

The construction, maintenance, and continuing operations associated with this network of development represent an extensive series of public and private investments, as well as changes in land use, surface disturbances, water consumption, and the factors that characterize local air quality. Those investments and changes have occurred over a period of time and in response to many different influences.

Some of the identified and anticipated plans or proposals for future investment in public, private, and commercial infrastructure in the PRB are summarized below.

- The Wyoming Department of Transportation (WYDOT) State Transportation Improvement Program for 2004 includes anticipated 2005 through 2009 construction costs of approximately $215.4 million for highway and airport maintenance, reconstruction, and improvement projects in the PRB Coal Review Study area. No construction of new highways is scheduled and no new airports are proposed between now and 2009.

- The 2008 annual State Transportation Improvement Program (STIP) includes planned construction for the 2008 fiscal year and preliminary engineering estimates for projects with anticipated construction dates through 2013 (WYDOT 2008). In general, Wyoming transportation

projects scheduled over the next 6 years include maintenance, reconstruction, and improvement projects. Airport improvement plans consist primarily of pavement rehabilitation and overlays, with some minor expansion of taxiways, aprons, and parking. No construction of new highways is scheduled, and no new airports are proposed.

- In addition to highway projects included in the STIP 2008, the Eagle Butte Mine has received approval from WYDOT to relocate a portion of U.S. Highway 14/16 in the vicinity of the Gillette/Campbell County Airport, north of the city of Gillette. The relocation is to facilitate the recovery of approximately 35 million tons of additional coal recently acquired by the mine through the West Eagle Butte West LBA tract coal sale. Three alternative alignments, involving the construction of up to 2.75 centerline miles of new roadway, were identified and a preferred alternative was subsequently chosen and approved by WYDOT. Construction of the new highway segment began in March of 2009 (WYDOT and Foundation Coal Company 2008).
- A $10.7 million expansion and renovation of the Campbell County courthouse was completed in late 2005 and a new public health building was completed in 2007.
- Expansion of the county's detention center and remodeling of the sheriff's office were undertaken in 2007.
- Expansion of the CAM-PLEX conference and multi-event center facility in Gillette was approved in a special election in May 2005.
- The 2005 approved master plans for Wyoming public school facilities spending included a total of $72.3 million in new capital construction for the seven school districts that are completely or partially in the Wyoming PRB study area (WSFC 2005).
- Construction and maintenance projects for the City of Gillette include a recently completed project to renovate and expand the waste water treatment plant.
- Commercial development includes recently completed construction of a Home Depot store and expansion of the Wal-Mart store in Gillette.
- A new $10 million headquarters for the Campbell County Fire Department providing administrative, training, and storage space in addition to multiple parking bays for firefighting apparatus.
- A $55 million county recreation center is being planned, with opening expected in 2010.

- The city completed construction of a new Health Sciences Center at Gillette College. The facility will house the school's nursing program, providing classrooms, labs, faculty offices, and other spaces. The nursing program functions in conjunction with the Campbell County Memorial Hospital.

- The county, city, and Gillette College are partnering on a Campus Housing Complex and Industrial Technical Education Center. These facilities are part of a long-range master plan for the college that is designed to provide a broad college-level curriculum and provide more focused education and training to support local business and industry.

- Campbell County Memorial Hospital is in the planning stage for a major expansion and renovation project (City of Gillette 2008a).

A capital facilities tax ballot question in Campbell County in the 2004 election asking voters to approve the imposition of a $0.01 sales and use tax (to be used for updated and expanded diesel mechanic and welding programs at the Gillette Campus of the Northern Wyoming Community College (now Gillette College) and for two community development projects in Wright) and an increase in the lodging tax were defeated in 2004. A renewed attempt to get the lodging tax on the ballot for the 2006 primary election failed to gain the approval of the Campbell County Board of Commissioners. In their 2007 session, the Wyoming Legislature committed to pay half of the cost of a technical education center at Gillette College that will house diesel technology, welding and industrial electrician programs. The Campbell County Board of Commissioners has approved a tax increase to pay for the other half of the cost of the project.

Given the timing, scale, year-to-year variability, relatively short construction timetables associated with such investments, the existence of a relatively large and diversified construction industry in the region and nearby areas, and the limited potential for these projects to alter long-term conditions in the PRB, they are not included in the PRB Coal Review analysis. However, one or more of these and similar projects could warrant consideration in a cumulative analysis for a site-specific project due to proximity or coincidental project schedules and timetables.

4.2 Cumulative Environmental Consequences

Section 4.1 of this chapter discusses existing and projected levels of development in the Wyoming PRB, and includes summaries of the results of PRB Coal Review Task 2 studies. This section summarizes the existing conditions resulting from baseline year (2003) development and the cumulative environmental consequences of the projected development for 2010, 2015, and 2020 based on the results of the analyses conducted for PRB Coal Review Task 1 and 3 reports, respectively.

As discussed in Section 4.1, the Wyoming portion of the PRB is the primary focus of the PRB Coal Review analyses. For the majority of resources in the Task 1 analysis, the Wyoming PRB Coal Review study area encompasses all of Campbell County, all of Sheridan and Johnson Counties outside of the Bighorn National Forest, and the northern portion of Converse County (figure 4-1). The study areas for the Task 3 analyses are different. For the majority of the resources considered in the PRB Coal Review, the Task 3 study area is based on watershed boundaries in the PRB and includes the portions of the Upper Powder River, Little Powder River, Upper Belle Fourche River, Upper Cheyenne River, Antelope Creek, and Dry Fork Cheyenne River subwatersheds that lie within Sheridan, Johnson, Campbell and northern Converse Counties (figure 4-4). This study area includes over 4 million acres. Table 4-10 summarizes the total disturbance and reclamation acreages for the baseline year of 2003 and the total projected disturbance and reclamation acreages for 2010, 2015, and 2020 within the Task 3 study area described above.

A total of approximately 220,688 acres of this land area had been disturbed by development activities as of 2003, which represents about 5.6 percent of the Task 3 study area. This is projected to increase to as much as 514,732 acres in 2020 under the upper coal production scenario which would represent approximately 13.1 percent of the Task 3 study area. This projected disturbance includes coal mining, coal-related development, and oil and gas and related development disturbance in the Task 3 study area. Areas reclaimed during each future time period shown in table 4-10 reflect how much of the disturbed acreage is projected to be permanently reclaimed by that point in time. The acres of unreclaimed disturbance would be reclaimed incrementally or following a project's completion, depending on the type of development activity and permit requirements. The acres currently not available for reclamation are occupied by long-term facilities that are needed to conduct mining operations or coal-related activities. These areas would be reclaimed near the end of each mine or facility's life.

Adjustments were made to the study area described above and shown in figure 4-4 for several resources as described below:

- The potential air quality impacts were evaluated over a multi-state area (including most of Wyoming, southeastern Montana, southwestern North Dakota, western South Dakota, and northwestern Nebraska) because they would be expected to extend beyond the Wyoming and Montana PRB study area that was used to identify emissions sources for the air quality analysis.

- The socioeconomic impact analysis focused on Campbell County, but also considered Converse, Crook, Johnson, Sheridan, and Weston counties as directly affected and Niobrara and Natrona counties as indirectly affected.

- The groundwater drawdown was evaluated in the area surrounding and extending west of the surface coal mines, shown in figure 4-4, because

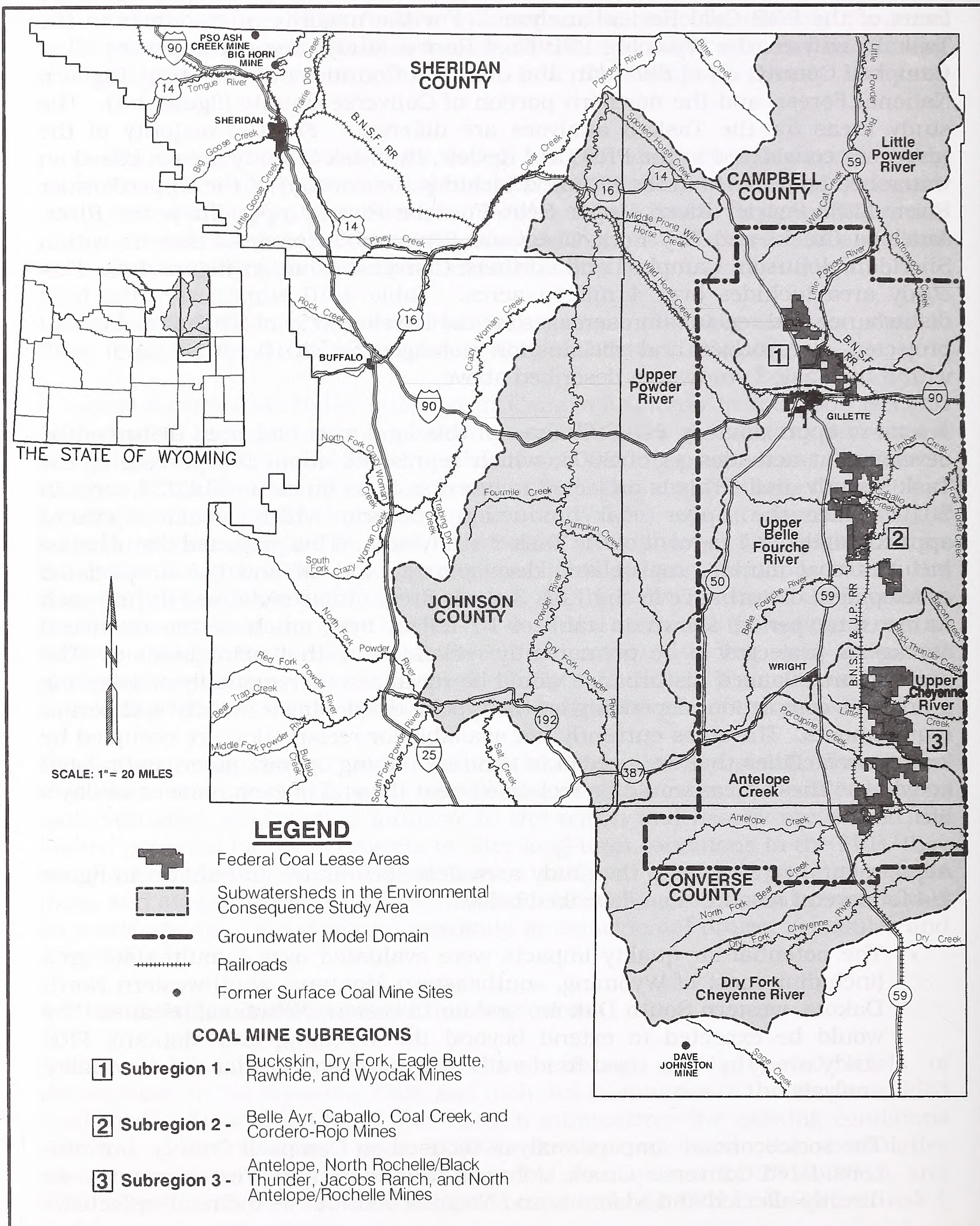


Figure 4-4. Wyoming Task 3 Study Area for PRB Coal Review Studies Evaluating Projected Environmental Consequences.

Table 4-10. Baseline Year and Projected Wyoming PRB Total Development Scenario – Task 3 Study Area.

Year	Total Acres Disturbed[1]	Acres Reclaimed[1]	Acres Unreclaimed[1]	Acres Unavailable for Reclamation[2]	Acres Affected by Coal Mining
Baseline Year					
2003	220,688	111,786	108,901	27,073	68,794
Projected Development - Lower Coal Production Scenario					
2010	339,912	205,113	134,799	29,389	98,662
2015	426,084	286,614	139,472	31,546	117,236
2020	503,085	367,999	135,085	32,794	137,443
Projected Development - Upper Coal Production Scenario					
2010	343,698	206,946	136,752	28,739	102,448
2015	433,392	290,822	142,570	31,006	124,545
2020	514,732	374,732	139,998	32,342	149,089

[1] Minor discrepancies in total acreages are the result of number rounding.
[2] Includes coal mine and coal-related disturbance.
Source: PRB Coal Review Task 2 Report (BLM 2005a)

- that is the area where groundwater drawdown related to surface coal mining operations and CBNG production operations would overlap.

4.2.1 Topography and Physiography

The PRB is located within the Upper Missouri Basin Broken Lands physiographic subprovince that includes northeastern Wyoming and eastern Montana to the Canadian border. The topography generally is of low to moderate relief with occasional buttes and mesas. The general topographic gradient slopes down gently from southwest to northeast with elevations ranging from 5,000 to 6,000 feet above sea level on the southern and western portions of the basin to less than 4,000 feet above sea level on the north and northeast along the Montana state line. The major drainages in the basin are the Tongue, Powder, Belle Fourche, and Cheyenne rivers. Most of the drainages in the area are intermittent and have flows during high precipitation events or during periods of snowmelt. The drainages are part of the upper Missouri River Valley drainage basin.

The disturbance associated with the majority of the past, present, and projected activities have resulted in or would result in the alteration of the surface topography. Surface coal mining, which is projected to continue in the area of the existing coal mines shown in figure 4-4, permanently alters the topography by removing the overburden and coal and then replacing the overburden.

Recontouring during reclamation to match approximate original contours, as required by regulation, reduces the long-term impact to topography. After mined-out areas are reclaimed, the restored land surfaces are typically gentler, with more uniform slopes and restored basic drainage networks. Oil and gas exploration and development has occurred and is projected to continue throughout most of the Task 3 study area. It also results in the alteration of topography to accommodate facilities (e.g., well pads, power plants, etc.) and

roads, but the disturbance tends to occur in smaller, more discrete areas than coal mining and the development is spread out over a larger area.

The disturbance and reclamation acreages associated with all existing and projected development in the Task 3 study area for the years 2003, 2010, 2015, and 2020 are given in table 4-10.

4.2.2 Geology, Mineral Resources, and Paleontology

The cumulative effects study area for geology, mineral resources, and paleontology is the PRB Coal Review Task 3 study area (figure 4-4).

The PRB is one of a number of structural basins in Wyoming and the Rocky Mountain area that were formed during the Laramide Orogeny. The basin is asymmetric with a structural axis that generally trends northwest to southeast along the western side of the basin (Flores et al. 1999). Natural earthquakes, landsides, and subsidence do not present a hazard in the PRB based on the lack of active faults in the study area (USGS 2004); the low risk of ground shaking in the region if a maximum credible earthquake were to occur (Frankel et al. 1997); and the absence of evidence of subsidence, landslides, or other geologic hazards in association with CBNG production. USGS monitors the magnitude of blasting activity in the PRB under the Routine Mining Seismicity Earthquake Hazards Program (USGS 2008). Coal mine blasting operations induced seismic activity does occur throughout the PRB and has reached a USGS local magnitude rating of 3.6 (USGS 2004).

4.2.2.1 Coal

Most of the coal resources of the basin are found in the Fort Union and Wasatch Formations. Although coals are present in the Wasatch, they are thinner and less continuous than the coals in the Fort Union and, therefore, they are not as economically important as the coals in the Fort Union for either coal mining or CBNG development. Projected levels of coal production and disturbance under the lower and upper coal production scenarios are shown in tables 4-2 and 4-3.

In the coal mine areas, the overburden and coal would be removed and the overburden replaced, resulting in a permanent change in the geology of the area and a permanent reduction of coal resources.

4.2.2.2 Oil and Gas

Drilling for conventional oil and gas in the Wyoming PRB has declined considerably in the last 15 years. However, as discussed above, increasing prices have led to increased interest in drilling and there remains potential for finding and developing these resources in the deeper formations of the basin. Conversely, CBNG production increased rapidly from 1999 through 2002 but began to level off in 2003. Projected production rates for conventional oil and gas and CBNG in 2010, 2015, and 2020 are shown in tables 4-6 and 4-7.

Oil and gas and related development accounts for most of the projected mineral disturbance outside of the coal mining areas. It generally would result in only shallow, discrete areas of surface disturbance, as discussed above. The acreages over which these impacts were occurring (as of 2003) and are projected to occur in the years 2010, 2015, and 2020 are shown in table 4-10.

4.2.2.3 Other Mineral Resources

As discussed in section 4.1.3.1, other mineral resources that are being mined in the Wyoming PRB include uranium, bentonite, clinker, and aggregate. Production of uranium and bentonite is not likely to be affected by development of coal or CBNG in the PRB. Aggregate and clinker production levels are more likely to be affected by other mineral development levels because these resources would be used in construction projects related to other mineral development.

4.2.2.4 Paleontology

Scientifically significant paleontological resources, including vertebrate, invertebrate, plant, and trace fossils, are known to occur in many of the geologic formations within the Wyoming PRB. These fossils are documented in the scientific literature, in museum records, and are known by paleontologists and land managers familiar with the area.

The Wasatch Formation is the most geographically widespread unit exposed on the surface over most of the Task 3 study area. It is underlain by the Fort Union Formation. The fossiliferous Morrison and Lance Formations crop out in the western portion of the basin but occur at depth in the vicinity of the coal mines and CBNG activity in the eastern portion of the basin. Within the Task 3 study area, the highly fossiliferous White River Formation occurs only on Pumpkin Buttes in southwestern Campbell County.

As of 2003, no significant or unique paleontological localities had been recorded on federal lands in the PRB. However, the lack of localities in the PRB does not mean that scientifically significant fossils are not present, as much of the area within and surrounding the PRB has not been adequately explored for paleontological resources. As a result, development activities in the Task 3 study area have the potential to adversely affect scientifically significant fossils, if they are present in or adjacent to disturbance areas.

The potential for impacts to scientifically significant fossils would be greatest in areas where Class 4 or 5 formations are present (see section 3.3.3.1). The Wasatch Formation is classified as a Class 5 formation. The Fort Union Formation is classified as a Class 3 formation, which means that fossil content varies in significance, abundance, and predictable occurrence. The greatest potential impact to surface and subsurface fossils would result from disturbance of surface sediments and shallow bedrock during construction and/or operations, depending on the type of project. Potential subsurface disturbance of paleontological resources (e.g., during drilling operations) would not be visible

or verifiable. The areas over which these impacts occurred as of 2003 and are projected to occur as a result of all projected development in the years 2010, 2015, and 2020 are shown in table 4-10. As only portions of the Task 3 study area have been evaluated for the occurrence of paleontological resources, and discrete locations for development activities cannot be determined at this time, no accurate estimate can be made as to the number of paleontological sites that may be affected by cumulative development activities.

Development activities which involve federally owned surface and/or minerals are subject to federal guidelines and regulations protecting paleontological resources. Protection measures, permit conditions of approval, and/or mitigation measures would be determined on a project-specific basis at the time of permitting to minimize potential impacts to paleontological resources as a result of these activities.

4.2.3 Air Quality

There is substantial scientific evidence that increased atmospheric concentrations of greenhouse gases (GHG) and land use changes are contributing to an increase in average global temperature. However since these gases are not regulated pollutants, a discussion of this subject has been included in section 4.2.14.

The Task 1A Report for the PRB Coal Review (BLM 2005b) documents the modeled air quality impacts of operations during a baseline year, 2002, using actual emissions and operations for that year. Emissions from permitted minor sources were estimated, due to unavailability of actual emissions data. The baseline year analysis evaluated impacts both within the PRB itself and at selected sensitive areas surrounding the region. The analysis specifically looked at impacts of coal mines, power plants, CBNG development, and other development activities. Results were provided for both Wyoming and Montana at the individual receptor areas. The Task 2 Report for the PRB Coal Review (BLM 2005a) identifies reasonably foreseeable development activities for the years 2010, 2015, and 2020.

The Task 3A Report for the PRB Coal Review (BLM 2006c) evaluates the impacts on air quality and air quality-related values for the year 2010 using the development levels projected for 2010 and the same model and meteorological data that were used for the baseline year study in the Task 1A Report. The updated Task 3A report for the PRB Coal Review Cumulative Air Quality Effects for 2015 uses a revised base line year of 2004 with revised projected 2015 scenarios. Impacts for 2015 and 2020 were projected qualitatively using a state of the art guideline dispersion model based on evaluation of anticipated changes in emissions and on modeled impacts for the 2015 lower and upper coal production scenarios. BLM has updated the model and conducted impact analysis for the year 2015 (BLM 2008e) Currently, a revised baseline year emissions inventory has been developed using 2004 actual emissions data or emissions estimates and has incorporated the recent analyses of emissions in

Wyoming and Montana, which were not available when the 2010 modeling study was done.

Existing and projected emissions sources for the baseline year (2004) and 2015 analyses were identified within a study area comprised of the following counties in the PRB in Wyoming and Montana:

- Campbell County, all of Sheridan and Johnson Counties except the Bighorn National Forest lands to the west of the PRB, and the northern portion of Converse County, Wyoming.
- Rosebud, Custer, Powder River, Big Horn, and Treasure Counties, Montana.

A state-of-the-art, guideline dispersion model was used to evaluate impacts of the existing and projected source emissions on several source groups, as follows:

- Near-field receptors in Wyoming and Montana covering the PRB Coal Review Task 1A and 3A study area in each state. Overall, the near-field receptor grid points were spaced at one kilometer intervals over the study area;
- Receptors in nearby federally designated pristine or "Class I" areas; and
- Receptors at other sensitive areas (Class II sensitive areas).

The EPA guideline CALPUFF model system version 5.8 (Scire et al. 1999) was used for this study, which differs from the version used in the Task 1A and original Task 3A studies. The impacts for the baseline year (2004) and for 2015 lower and upper coal production scenarios were directly modeled. As discussed above, the modeling domain extends over most of Wyoming, southeastern Montana, southwestern North Dakota, western South Dakota, and western Nebraska. An interagency group participated in developing the modeling protocol and related domain that were used for this analysis.

The modeling approach for the updated Task 3A Report used actual emissions from existing sources representative of 2004 operations and projected those emissions for the expected level of development in 2015. Year 2004 emission inventory data were previously developed for the Montana Statewide Oil and Gas Supplemental Environmental Impact Statement. No specific emissions data were available for the projected levels of development. The baseline year emissions data were gathered from a variety of sources, but mainly relied on data collected by the WDEQ/AQD and the Montana Department of Environmental Quality (MDEQ). Only actual emission sources inside the study area described above were included in the modeling. Key major sources were included, such as the coal-fired power plants, gas-fired power plants, and sources that were included in the Title V (operating permit) program. The Dave Johnston power plant, which is located outside of but adjacent to the study area in Converse County,

was included in the baseline year study and in the projected emissions. Some operational adjustments were made to accommodate small sources with air permits that were presumed to be operating at less than full capacity. Emissions from other sources, including estimated construction-related fugitive dust emissions, were computed based on EPA emission factors and on input data from WDEQ/AQD.

The existing regional air quality conditions generally are good in the PRB Coal Review Task 1A and Task 3A study area. There are limited air pollution emissions sources (few industrial facilities, including the surface coal mines, and few residential emissions in relatively small communities and isolated ranches) and good atmospheric dispersion conditions. The available data show that the region is in compliance with the ambient air quality standards for nitrogen dioxide (NO_2) and sulfur dioxide (SO_2). There have been no monitored exceedances of the annual PM_{10} (particulates finer than 10 microns in effective diameter) standard in the Wyoming PRB.

Air quality modeling, as stated in the *Update of Task 3A Report for the Powder River Basin Coal Review Cumulative Air Quality Effects for 2015*, predict that the projected air quality impacts in Wyoming near the four South Gillette area operating mines will exceed the NAAQS for both the 24 hour and the annual PM_{10} and $PM_{2.5}$ (particulates finer than 2.5 microns in effective diameter) in the near-field for both the high and low production scenarios in 2015. Annual NO_2 air standards are not exceeded. The model suggests that this is caused by a combination of both CBNG operations and coal mining activity impacts in the area. All applicants have indicated that they propose to mine the respective LBA tracts at a rate below the permit levels. Visibility data collected around the region indicate that, although there are some days with notable impacts at Class I areas, the general trend in the region shows little change in visibility impacts at Badlands National Park and at the Jim Bridger Wilderness area over the period from 1989 to 2005 (figure 3-20).

Predicted impacts from baseline year (2004) and projected 2015 emissions were modeled for four air quality criteria pollutants (NO_2, SO_2, $PM_{2.5}$, and PM_{10}), along with changes in air quality-related values at Class I areas and at identified sensitive areas. For regulatory purposes, the Class I PSD (Prevention of Significant Deterioration) evaluations are not directly comparable to the air quality permitting requirements, because the modeling effort does not identify or separately evaluate increment consuming sources that would need to be evaluated under the PSD program. The cumulative impact analysis focuses on changes in cumulative impacts, but not on a comparison to PSD-related evaluations, which would apply to specific sources.

Table 4-11 presents the modeled impacts on ambient air quality at the near-field receptors in Montana and Wyoming. Results indicate the maximum impacts at any point in each receptor group, and data are provided for the baseline year (2004) analysis and for both coal production scenarios for 2015.

Table 4-11. Projected Maximum Potential Near-field Impacts (µg/m³).

Pollutant	Averaging Time	Base Year (2004) Impacts	2015 Lower Coal Development Scenario Impacts	2015 Upper Coal Development Scenario Impacts	NAAQS	Wyoming AAQS	Montana AAQS	PSD Class II Increments
Wyoming Near-field								
NO_2	Annual	31.3	46.7	47.4	100	100	--[1]	25
SO_2	Annual	15.3	16.2	16.2	80	60	---	20
	24-hour	112.3	119.6	119.6	365	260	---	91
	3-hour	462.0	814.1	814.1	1,300	1,300	---	512
$PM_{2.5}$	Annual	13.4	**18.7**	**21.4**	15	15	---	---
	24-hour	**87.6**	**179.5**	**179.5**	35	35	---	---
PM_{10}	Annual	38.4	**53.5**	**61.0**	---	50	---	17
	24-hour	**250.4**	**512.8**	**512.9**	150	150	---	30
Montana Near-field								
NO_2	Annual	3.3	6.5	6.5	100	---	100	25
	1-hour	409.0	**826.3**	**826.4**	---	---	564	---
SO_2	Annual	1.6	1.7	1.7	80	---	80	20
	24-hour	16.1	16.5	16.6	365	---	365	91
	3-hour	65.0	66.5	66.5	1,300	---	1,300	512
	1-hour	162.9	166.6	166.6	---	---	1,300	---
$PM_{2.5}$	Annual	1.0	1.8	1.9	15	---	15	---
	24-hour	10.2	15.4	20.6	35	---	35	---
PM_{10}	Annual	2.8	5.2	5.3	---	---	50	17
	24-hour	29.1	44.0	58.5	150	---	150	30

[1] No standard or increment

Value units are microgram per cubic meter (µg/m³)

Bold values indicate projected exceedance of AAQS

Source: PRB Coal Review Task 3A Report (BLM 2008e)

Based on the modeling results, the baseline year (2004) maximum impacts on ambient air quality were well below the ambient air quality standards for NO_2 and SO_2. The Annual $PM_{2.5}$ and PM_{10} impacts in Wyoming are predicted to be over the Wyoming Annual Air Quality Standard (AAQS) for the 2015 lower and upper development scenarios.

The 2004 maximum modeled 24-hour PM_{10} and $PM_{2.5}$ levels in Montana are also well below the state and national AAQS; however, the 2004 maximum modeled 24-hour PM_{10} and $PM_{2.5}$ levels are greater than the 150 $\mu g/m^3$ and 35 $\mu g/m^3$ AAQS, respectively, for some near-field receptors near PRB sources in Wyoming. The modeling also indicated that visibility impacts in the surrounding Class I and Class II areas for the modeled year 2015 showed some increase in visibility impacts.

For the Montana near-field projected impacts, the modeling for the 24-hour PM_{10} and $PM_{2.5}$ levels projects a maximum impact below the state and national AAQS for both coal production scenarios for 2015. The upper coal production scenario shows an increase in the impact of roughly 100 percent above the baseline year for these two parameters. Projected impacts for SO_2 and annual NO_2 show compliance with the National Ambient Air Quality Standard (NAAQS) and Montana AAQS. The 1-hour NO_2 projected levels for the lower and upper development scenarios are above the Montana AAQS. For the Montana receptors, modeling for the NO_2 and SO_2 levels were projected to be essentially equal for both coal development scenarios for 2015.

For the Wyoming near-field receptors, the modeling projects maximum 24-hour PM_{10} levels greater than the 150 $\mu g/m^3$ ambient air standard for the 2015 lower and upper coal production scenarios at some receptors. For the 2015 upper development scenario, the modeled levels are above 150 $\mu g/m^3$ for several relatively small areas surrounding coal mines and CBNG operations in the Wyoming PRB. As shown in table 4-11, the maximum modeled PM_{10} impacts from all sources for both the 2015 lower and upper coal development scenarios are over three times the 24-hour Wyoming AAQS standard. The maximum modeled $PM_{2.5}$ impacts from all sources for both the 2015 lower and upper coal development scenarios are over five times the 24-hour Wyoming AAQS standard.

As discussed in section 3.4.2.2.1, modeling tends to over-predict the 24-hour impacts of surface coal mining and, as a result, WDEQ/AQD does not consider short-term PM_{10} modeling to be an accurate representation of short-term impacts. In view of this, a Memorandum of Agreement between WDEQ/AQD and EPA Region VIII, dated January 24, 1994, allows WDEQ/AQD to conduct monitoring in lieu of short-term modeling for assessing coal mining-related impacts in the PRB. This agreement also requires "Best Available Work Practice" mitigation measures in all coal mine permits. The monitored exceedances at surface coal mines in the Wyoming PRB and the measures that WDEQ/AQD has implemented or is proposing to implement to prevent future exceedances of the PM_{10} NAAQS are discussed in chapter 3, sections 3.4.2.1 and 3.4.2.3.

The maximum modeled impacts on the annual $PM_{2.5}$ and PM_{10} annual levels are projected to be above the standard (15 μg/m^3 and 50 μg/m^3, respectively) at near-field receptors in Wyoming for the 2015 lower and upper coal production scenario. EPA has revoked the annual PM_{10} standard of 50 μg/m^3 but until Wyoming enters into rulemaking to revise the WAAQS, that standard is still effective. It should be noted that WDEQ/AQD issues permits to mine coal. AQD cannot issue any permit that violates Ambient Air Quality Standards. Impacts of NO_2 and SO_2 emissions are predicted to be below the NAAQS and Wyoming SAAQS at all Wyoming near-field receptors. A large portion of the impacts for all scenarios would be associated with coal-related sources, although non-coal sources would contribute a notable portion of the impact.

Table 4-12 lists the three Class I areas and two Class II areas where the modeled impacts are the greatest. Table 4-12 includes a comparison to ambient air quality standards and PSD increments; however, it must be noted that this modeling analysis did not separate PSD increment-consuming sources from those that do not consume increment. The PSD-increment comparison is provided for informational purposes only and cannot be directly related to a regulatory interpretation of PSD increment consumption. For the Class I Northern Cheyenne Indian Reservation, modeled impacts for the baseline year (2004) and the two coal production scenarios for 2015 are less than the annual SO_2 PSD Class I and Class II increment; below the PSD Class I and Class II increment levels for annual PM_{10}, 24-hour SO_2, and 3-hour SO_2. The levels for 24-hour PM_{10} are above the Class I and Class II PSD increment levels in the base line year of 2004 and show potential exceedances in both the lower and upper development scenarios. For annual NO_2, the modeled impacts for the Northern Cheyenne Reservations are less than the annual increment for the baseline year and lower and upper coal production scenarios.. In the other two Class I areas, only the 24-hour PM_{10} impacts are higher than the comparison to the PSD increment levels for the baseline year and both coal production scenarios. In the sensitive Class II areas, all modeled impacts are well below the Class II PSD increment for the lower coal production scenario. The modeled 24-hour PM_{10} in both of the Class II areas indicates potential exceedances in the upper coal production scenario.

The projected modeled visibility impacts for the baseline year (2004) and for the lower and upper coal production scenarios for 2015 for all analyzed Class I and sensitive Class II areas are listed in table 4-13. For the baseline year, the maximum visibility impacts at Class I areas were determined to be at the Northern Cheyenne Indian Reservation in Montana and at Wind Cave and Badlands National Parks in South Dakota. For these locations, modeling showed more than 200 days of impacts with a change of 10 percent or more in extinction. A 10 percent change in extinction corresponds to 1.0 deciview (dv).

To provide a basis for discussing the modeled visibility impacts resulting from the projected increased production under the lower and upper coal production scenarios for 2015, the modeled visibility impacts for 2004 were subtracted from the model results for 2015. Table 4-13 shows the number of additional days

Table 4-12. Maximum Predicted PSD Class I and Sensitive Class II Area Impacts (μg/m^3)[1].

Location	Pollutant	Averaging Period	Base Year (2004) Impacts	2015 Lower Coal Development Scenario	2015 Upper Coal Development Production Scenario	PSD Class I/II Increments
Class I Areas						
Northern Cheyenne Indian Reservation	NO_2	Annual	0.4	0.6	**0.9**	2.5
	SO_2	Annual	0.5	0.6	0.7	2
		24-hour	3.1	3.4	3.4	5
		3-hour	9.4	9.6	9.6	25
	$PM^{2.5}$	Annual	0.3	0.5	0.5	---[2]
		24-hour	3.4	5.1	5.1	---
	PM_{10}	Annual	0.9	1.5	1.5	4
		24-hour	**9.6**	**14.4**	**14.6**	8
Washakie Wilderness Area	NO_2	Annual	0.0	0.0	0.0	2.5
	SO_2	Annual	0.2	0.2	0.2	2
		24-hour	3.0	3.1	3.1	5
		3-hour	6.3	6.3	6.3	25
	$PM^{2.5}$	Annual	0.1	0.1	0.1	---
		24-hour	1.6	1.6	1.6	---
	PM_{10}	Annual	0.2	0.2	0.2	4
		24-hour	4.5	4.6	4.7	8
Wind Cave National Park	NO_2	Annual	0.2	0.3	0.3	2.5
	SO_2	Annual	0.7	0.8	0.8	2
		24-hour	3.7	4.1	4.1	5
		3-hour	7.0	7.4	7.4	25
	$PM^{2.5}$	Annual	0.4	0.5	0.5	---
		24-hour	3.8	4.6	4.7	---
	PM_{10}	Annual	1.0	1.3	1.4	4
		24-hour	**10.9**	**13.3**	**13.6**	8
Sensitive Class II Areas						
Big Horn Canyon National Recreation Area	NO_2	Annual	0.6	0.6	0.7	25
	SO_2	Annual	0.5	0.6	0.6	20
		24-hour	3.6	3.7	4.0	91
		3-hour	14.3	14.3	14.3	512
	$PM^{2.5}$	Annual	0.5	0.5	0.7	---
		24-hour	5.9	7.8	11.9	---
	PM_{10}	Annual	1.4	1.6	2.1	17
		24-hour	16.9	22.3	**34.1**	30
Crow Indian Reservation	NO_2	Annual	0.9	1.4	1.7	25
	SO_2	Annual	2.3	2.3	2.3	20
		24-hour	14.4	14.6	14.6	91
		3-hour	76.8	77.0	77.0	512
	$PM^{2.5}$	Annual	0.8	1.0	1.4	---
		24-hour	7.2	9.4	14.3	---
	PM_{10}	Annual	2.2	2.9	4.1	17
		24-hour	20.5	26.9	**40.7**	30

[1] μg/m^3 = microgram per cubic meter.
[2] No standard or increment.
Bold values indicate exceedance of PSD Class I or II standards.
Source: PRB Coal Review Task 3A Report (BLM 2008e)

Table 4-13. Modeled Change in Visibility Impacts at Class I and Sensitive Class II Areas.

Location	Base Year (2004) No. of Days >10%	2015 Lower Coal Development Scenario Change in No. of Days >10%	2015 Upper Coal Development Scenario Change in No. of Days >10%
Class I Areas			
Badlands National Park	218	26	26
Bob Marshall WA	8	0	0
Bridger WA	144	2	2
Fitzpatrick WA	91	2	2
Fort Peck Indian Reservation	105	10	10
Gates of the Mountain WA	55	0	0
Grand Teton National Par	70	2	2
North Absaroka WA	61	3	3
North Cheyenne Indian Reservation	243	32	47
Red Rock Lakes	42	2	2
Scapegoat WA	27	1	1
Teton W	57	4	4
Theodore Roosevelt National Park	178	5	9
UL Bend WA	77	8	10
Washakie WA	83	5	5
Wind Cave National Park	262	18	19
Yellowstone National Park	84	2	2
Sensitive Class II Areas			
Absaroka Beartooth WA	101	2	3
Agate Fossil Beds National Monument	251	20	20
Big Horn Canyon National Rec. Area	331	1	3
Black Elk WA	236	34	36
Cloud Peak WA	126	18	18
Crow Indian Reservation	360	4	4
Devils Tower National Monument	274	25	25
Fort Belknap Indian Reservation	66	6	7
Fort Laramie National Historic Site	260	10	10
Jedediah Smith WA	79	1	1
Jewel Cave National Monument	261	19	21
Lee Metcalf WA	97	2	2
Mount Naomi WA	51	1	1
Mount Rushmore National Monument	222	36	36
Popo Agie WA	139	4	4
Soldier Creek WA	268	18	18
Wellsville Mountain WA	130	10	10
Wind River Indian Reservation	217	2	5

Source: PRB Coal Review Task 3A Report (BLM 2008e)

that the projected impacts were greater than 1.0 dv (10 percent in extinction) for each site for the upper and lower coal production scenarios. Using Badlands Park as an example, the modeling analysis showed 218 days with impacts greater than 1.0 dv in 2004. Under the 2015 lower coal production scenario, the modeling analysis projects an additional 26 days with impacts greater than 1.0 dv, or a total of 244 days with impacts greater than 1.0 dv.

For acid deposition, all predicted impacts are below the deposition threshold values for both nitrogen and sulfur compounds. There are substantial percentage increases in deposition under the lower and upper coal production scenarios for 2015; however, impacts remain well below the nitrogen and sulfur levels of concern (1.5 and 5.0 kilograms per hectare per year (kg/ha/yr), respectively). The acid neutralizing capacity (ANC) of sensitive lakes also was analyzed, and results are summarized in table 4-14. The base year study indicated that none of the lakes had predicted significant impacts except Upper Frozen Lake; however, the lower and upper development scenarios for 2015 show an increased impact at Florence Lake, leading to an impact that is above the 10 percent ANC.

The study also modeled impacts of selected hazardous air pollutant emissions (benzene, ethyl benzene, formaldehyde, n-hexane, toluene, and xylene) on the receptors with the highest ambient impacts. The near-field receptors in Wyoming and Montana were analyzed for annual (chronic) and 1-hour (acute) impacts. Model results for the base year (2004) and 2015 development scenarios show that impacts are predicted to be well below the acute Reference Exposure Levels, non-carcinogenic Reference Concentrations for Chronic Inhalation, and carcinogenic risk threshold for all hazardous air pollutants. The maximally exposed individual's carcinogenic risk factor due to benzene exposure is predicted to increase 50 percent as a result of projected PRB development, but even with this substantial increase the predicted risk is well below U.S. Environmental Protection Agency (EPA) carcinogenic risk thresholds.

For 2020, the PRB Coal Review updated Task 3A Report includes a qualitative analysis of potential air quality impacts and the impacts from individual source groups, based on the projected changes from 2004 to 2015 for the respective coal production scenarios. The production from conventional oil and gas activities is projected to peak at 2010, with slight declines predicted over the following decade. The production from CBNG activities is projected to peak at 2015, with slight declines predicted over the following decade. Therefore, from these sources, expected impacts would decrease slightly from 2015 to 2020. The coal mining sources would be the major contributors to PM_{10} and $PM_{2.5}$ impacts in the near-field between 2015 and 2020, and these impacts would result from the proximity of the receptors to the coal mining operations. If coal mines expand or relocate, those impacts likely would follow that development; however, the specific impacts would need to be addressed with a more refined modeling effort.

Table 4-14. Predicted Total Cumulative Change in Acid Neutralizing Capacity of Sensitive Lakes.

Location	Lake	Background ANC (μeq/L)	Area (hectares)	Base Year 2004 Change (percent)	2015 Lower Coal Development Scenario Change (percent)	2015 Upper Coal Development Scenario Change (percent)	Thresholds (percent)
Bridger Wilderness Area	Black Joe	67.0	890	4.00	4.11	4.11	10
	Deep	60.0	205	4.70	4.82	4.82	10
	Hobbs	70.0	293	3.95	4.03	4.03	10
	Upper Frozen	5.0	64.8	2.42	2.47	2.48	1[1]
Cloud Peak	Emerald	55.3	293	5.24	5.97	6.02	10
	Florence	32.7	417	9.09	10.41	10.48	10
Fitzpatrick Wilderness Area	Ross	53.5	4,455	2.72	2.79	2.79	10
Popo Agie Wilderness Area	Lower Saddlebag	55.5	155	6.28	6.42	6.43	10

[1] Data for Upper Frozen Lake presented in changes in μeq/L rather than percent change. (For lakes with less than 25 μeq/L background ANC.)
Source: PRB Coal Review Task 3A Report (BLM 2008e)

Power plants currently are the major contributors to all SO_2 impacts in the near-field in both states. However, the projected impacts are well below any ambient standard or PSD increment. According to the PRB Coal Review Air Quality modeling analysis, predicted future expansion modeled to the year 2020 should not jeopardize the attainment of those standards. Impacts on NO_2 concentrations are the result of emissions from all the source groups. No one source group dominates the NO_2 impacts in the near-field.

A pattern that is similar to the near-field receptors holds true for the Class I and sensitive Class II receptor groups. Essentially, the mine operations would continue to dominate the PM_{10} and $PM_{2.5}$ impacts, the power plants would continue to dominate the SO_2 impacts (although they would continue to be below the standards), and the overall source groups would continue to contribute to NO_2 impacts. Impacts should remain below the annual NO_2 standard for 2015 and 2020 in Wyoming and Montana. The 1-hour NO_2 Montana near-field impacts indicate potential exceedances.

Based on modeling results, one of lakes (Florence) in the Cloud Peak Class I area and one lake (Upper Frozen Lake) in the Bridger Class I area, exceeded the acid deposition thresholds for both the lower and upper coal production scenarios for 2015. With the exception of Florence and Upper Frozen lakes, the projected increases in coal development (and power plants) are not expected to raise the deposition levels above the thresholds, extended into 2020. The model results showed that the increased deposition, largely from SO_2 emissions from power plants, exceeded the thresholds of significance for the ANC at sensitive (high alpine) lakes. The results indicate that with increased growth in power plant operations, the reduced ANC of the sensitive lakes would need to be addressed carefully for each proposed major development project.

WDEQ/AQD and WDEQ/LQD mitigation and monitoring requirements for coal mine emissions are discussed in sections 3.4.2.3 and 3.4.3.3. The discussion in these sections includes the operational control measures that are currently in place and would be required for mining operations on LBAs that are issued in the future, as well as measures that may be required to avoid future exceedances of the WAAQS and NAAQS and/or future mine-related impacts to the public.

4.2.4 Water Resources

Surface and groundwater are used extensively throughout the PRB for agricultural water supply, municipal water supply, and both domestic and industrial water supply. Surface water use is limited to major perennial drainages and agricultural areas within the basin are found mainly along these drainages. Municipal water supply comes from a combination of surface and groundwater. Domestic and industrial water supply primarily is from groundwater.

The PRB Coal Review Task 1B Report (BLM 2006d) describes the existing water resource conditions in the PRB Task 1 study area (figure 4-1). The Task 3B Report (BLM 2006e) provides an assessment of the cumulative impact to surface and ground water resources associated with future projected levels of coal mining, coal mine dewatering, CBNG groundwater withdrawal and surface disposal, and coal mine and conventional oil and gas surface disposal of groundwater in the Task 3 study area (figure 4-4). The groundwater portion of the impact analysis has not yet been completed. The surface water analysis addresses the cumulative impacts to surface water quality and channel stability as a result of surface discharge of groundwater by CBNG development and coal mine dewatering. The surface water quality portion of this analysis has been completed, but the channel stability portion is not yet complete. The following discussion includes a summary of the results of the Task 1B Report and the Task 3B surface water quality impact analysis, including a recent channel stability study. The Task 3B groundwater impact analysis will be incorporated into future EIS analyses when completed.

<u>4.2.4.1 Groundwater</u>

There are five main aquifers in the PRB Coal Review Task 1 study area (figure 4-1) that can be used for water supply:

- Madison Aquifer System;
- Dakota Aquifer System;
- Fox Hills/Lance Aquifer System;
- Fort Union/Wasatch Aquifer System; and
- Quaternary Alluvial Aquifer System.

The Fort Union/Wasatch Aquifer System includes the coal and overburden aquifers that are directly affected by surface coal mining and CBNG development. It is also a major source of local water supply for domestic and stock water use. Table 4-15 shows the recoverable groundwater in the components of the Fort Union/Wasatch Aquifer System. The volumes of recoverable groundwater from the sandstones within the Wasatch/Tongue River Aquifer, the Lebo Confining Layer, and the Tullock Aquifer were determined from the volume of sandstone in each of these units multiplied by the 13 percent specific yield value for sandstone. Similarly, the volume of recoverable groundwater from the coals within the Wasatch/Tongue River was calculated from the volume of coal multiplied by the 0.4 percent specific yield value for coal.

As a result of statutory requirements and concerns, several studies and a number of modeling analyses have been conducted to help predict the impacts of surface coal mining on groundwater resources in the Wyoming portion of the PRB. Some of these studies and modeling analyses are discussed below.

In 1987, the USGS, in cooperation with the WDEQ and Office of Surface Mining Reclamation & Enforcement (OSM), conducted a study of the hydrology of the eastern PRB. The resulting description of the cumulative hydrologic effects of all

Table 4-15. Recoverable Groundwater in the Fort Union/Wasatch Aquifer System.

Hydrogeologic Unit	Surface Area (acres)	Average Formation Thickness (ft)	Percentage of Sand/Coal	Average Sand/Coal Thickness (ft)	Specific Yield (percent)	Recoverable Groundwater (acre-feet)[1]
Wasatch-Tongue River Aquifer Sandstones	5,615,609	2,035	50.0	1,018	13.0	743,169,695
Wasatch-Tongue River Aquifer Coals	4,988,873	2,035	6.2	126	0.4	2,514,392
Lebo Confining Layer Sandstones	6,992,929	1,009	33.0	250	13.0	227,270,193
Tullock Aquifer Sandstones	7,999,682	1,110	52.0	430	13.0	447,182,224

[1] Calculated by multiplying Surface Area × Average Sand/Coal Thickness × Specific Yield. These numbers vary slightly from the numbers presented in table 3-5 of the Final Environmental Impact Statement and Proposed Plan Amendment for the PRB Oil and Gas Project (BLM 2003).

Source: BLM 2003

current and anticipated surface coal mining (as of 1987) was published in 1988 in the USGS Water-Resources Investigation Report entitled "*Cumulative Potential Hydrologic Impacts of Surface Coal Mining in the Eastern Powder River Structural Basin, Northeastern Wyoming*", also known as the "USGS CHIA" (Martin et al. 1988). This report evaluates the potential cumulative groundwater impacts of surface coal mining in the area and is incorporated by reference into this EIS. The USGS CHIA analysis considered the proposed mining at the Antelope Mine. It did not evaluate potential groundwater impacts related to additional coal leasing in this area and it did not consider the potential for overlapping groundwater impacts from coal mining and CBNG development.

Each mine must assess the probable hydrologic consequences of mining as part of the mine permitting process. The WDEQ/LQD must evaluate the cumulative hydrologic impacts associated with each proposed mining operation before approving the mining and reclamation plan for each mine, and they must find that the cumulative hydrologic impacts of all anticipated mining would not cause material damage to the hydrologic balance outside of the permit area for each mine. As a result of these requirements, each existing approved mining permit includes an analysis of the hydrologic impacts of the surface coal mining proposed at that mine. If major amendments to mining and reclamation permits are proposed, then the potential cumulative impacts of the revisions must also be evaluated. If the four South Gillette Area Coal LBA tracts are leased to the respective applicants, the existing mining and reclamation permits for each current mine must be revised and approved to include the new lease before it can be mined.

The PRB Oil and Gas Project FEIS (BLM 2003) includes a modeling analysis of the groundwater impacts if an additional 39,000 new CBNG wells are drilled in

the PRB by the end of 2011. The project area for this EIS, which covers all of Campbell, Sheridan, and Johnson Counties, as well as the northern portion of Converse County, is similar to the study area for the PRB Coal Review Task 1 and Task 2 study area (figure 4-1).

Another source of data on the impacts of surface coal mining on groundwater is the monitoring that is required by WDEQ/LQD and administered by the mining operators. Each mine is required to monitor groundwater levels and quality in the coal and in the shallower aquifers in the area surrounding their operations. Monitoring wells are also required to record water levels and water quality in reclaimed areas.

The coal mine groundwater monitoring data are published each year by the Gillette Area Groundwater Monitoring Organization (GAGMO), a voluntary group formed in 1980. Members of GAGMO include most of the companies with operating or proposed mines in the Wyoming PRB, WDEQ, the Wyoming SEO, BLM, USGS, and OSM. GAGMO contracts with an independent firm each year to publish the annual monitoring results. GAGMO also periodically publishes reports summarizing the water monitoring data collected since 1980 in the Wyoming PRB (e.g., Hydro-Engineering 1991, 1996, 2001b, and 2007).

The major groundwater issues related to surface coal mining that have been identified are:

- the effect of the removal of the coal aquifer and any overburden aquifers within the mine area and replacement of these aquifers with backfill material;
- the extent of the temporary lowering of static water levels in the aquifers around the mine due to dewatering associated with removal of these aquifers within the mine boundaries;
- the effects of the use of water from the subcoal Fort Union Formation by the mines;
- changes in water quality as a result of mining; and
- potential overlapping drawdown due to proximity of coal mining and CBNG development.

The impacts of large scale surface coal mining on a cumulative basis for each of these issues are discussed in the following paragraphs.

The effect of replacing the coal and overburden with backfill is the first major groundwater concern. The following discussion of recharge, movement, and discharge of water in the backfill aquifer is excerpted from the USGS CHIA (Martin et al. 1988):

> Postmining recharge, movement, and discharge of groundwater in the Wasatch aquifer and Wyodak coal aquifer will probably not be substantially different from premining conditions. Recharge rates and mechanisms will not change substantially. Hydraulic conductivity of the spoil aquifer will be approximately the same as in the Wyodak coal aquifer allowing groundwater to move from recharge areas where clinker is present east of mine areas through the spoil aquifer to the undisturbed Wasatch aquifer and Wyodak coal aquifer to the west.

Monitoring data verify that recharge has occurred and is continuing in the backfill (Hydro-Engineering 1991, 1996, 2001b, and 2005). The water monitoring summary reports prepared each year by GAGMO list current water levels in the monitoring wells completed in the backfill and compare them with the 1980 water levels, as estimated from the 1980 coal water-level contour maps. In the 1991 GAGMO 10-year report, some recharge had occurred in 88 percent of the 51 backfill wells reported at that time (Hydro-Engineering 1991). In the GAGMO 20-year report, 79 percent of the 82 backfill wells measured contained water (Hydro-Engineering 2001b). In the GAGMO 25-year report, 8.6 percent of the 101 backfill wells measured contained water (Hydro-Engineering 2007).

Coal companies are required by state and federal law to mitigate any water rights that are interrupted, discontinued, or diminished by mining.

The cumulative size of the backfill area in the PRB and the duration of mining activity would be increased by mining the currently pending LBA tracts, including the four South Gillette Area Coal LBA tracts. Because the mined-out areas are being backfilled and the monitoring data demonstrate that recharge of the backfill is occurring, substantial additional impacts are not anticipated as a result of the pending leasing actions.

Scoria or clinker, the baked and fused rock formed by prehistoric burning of the Wyodak-Anderson coal seam, occurs all along the coal outcrop area (figure 4-5) and is believed to be the major recharge source for the backfill aquifer, just as it is for the coal. However, not all clinker is saturated. Some scoria is mined for road-surfacing material, but saturated clinker is not generally mined since abundant clinker exists above the water table and does not present the mining problems that would result from mining saturated clinker. Therefore, the major recharge source for the backfill aquifer is not being disturbed by current mining. Scoria occurs only in limited amounts on the LBA tracts as applied for under the Proposed Actions or within the additional areas evaluated under the other action alternatives.

The second major groundwater issue is the extent of water level drawdown in the coal and shallower aquifers in the area surrounding the mines. In general, the saturated sand aquifers in the Wasatch Formation overburden have limited extent and, as a result, the drawdowns in the Wasatch Formation are much smaller and cover much less area than the coal drawdowns. In this EIS,

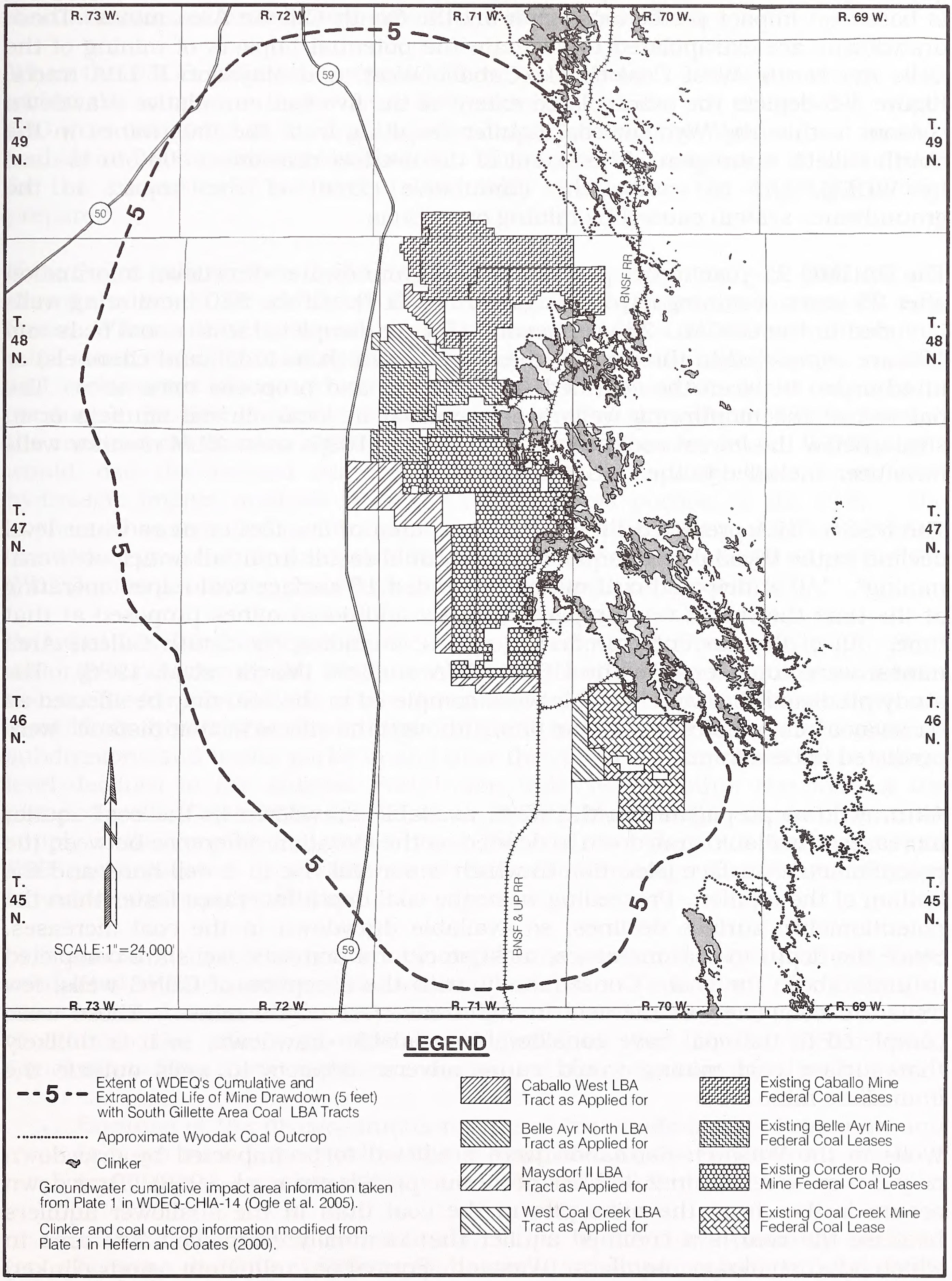


Figure 4-5. Extrapolated Extent of Life of Mine Cumulative Drawdown Within the Wyodak Coal Aquifer With the Addition of the South Gillette Area Coal LBA Tracts.

assessment of cumulative impacts to groundwater related to surface coal mining is based on impact predictions made by the South Gillette Area mines Those drawdowns are extrapolated to evaluate the potential impacts of mining of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts. Figure 4-5 depicts the extrapolated extent of the five-feet cumulative drawdown contour within the Wyodak coal aquifer resulting from the four mines in the South Gillette subregion. The extent of the five-feet drawdown contour is used by WDEQ/LQD to assess the cumulative extent of the impact to the groundwater system caused by mining operations.

The GAGMO 25-year report provides actual groundwater drawdown information after 25 years of mining (Hydro-Engineering 2007). Of the 530 monitoring wells included in the GAGMO 25-year report, 195 are completed in the coal beds and 193 are completed in the overlying sediments (which include sand channels) or interburden between the coal beds at 16 active and proposed mine sites. The balance of the monitoring wells are completed in local alluvial aquifers or in strata below the lowest coal seam mined. Since 1996, some BLM monitor wells have been included in the GAGMO reports.

The USGS CHIA predicted the approximate area of five feet or more water level decline in the Wyodak coal aquifer which would result from "all anticipated coal mining". "All anticipated coal mining" included 16 surface coal mines operating at the time the report was prepared and six additional mines proposed at that time. All of the currently producing mines, including the South Gillette Area mines, were considered in the USGS CHIA analysis (Martin et al. 1988). The study predicted that water supply wells completed in the coal may be affected as far away as eight miles from mine pits, although the effects at that distance were predicted to be minimal.

As drawdown propagates to the west, available drawdown in the coal aquifer increases. Available drawdown is defined as the elevation difference between the potentiometric surface (elevation to which water will rise in a well bore) and the bottom of the aquifer. Proceeding west, the coal depth increases faster than the potentiometric surface declines, so available drawdown in the coal increases. Since the depth to coal increases, most stock and domestic wells are completed in units above the coal. Consequently, with the exception of CBNG wells, few wells are completed in the coal in the areas west of the mines. Those wells completed in the coal have considerable available drawdown, so it is unlikely that surface coal mining would cause adverse impacts to wells outside the immediate mine area.

Wells in the Wasatch Formation were predicted to be impacted by drawdown only if they were within 2,000 feet of a mine pit (Martin et al. 1988). Drawdown occurs farther from the mine pits in the coal than in the shallower aquifers because the coal is a confined aquifer that is areally extensive. The area in which the shallower aquifers (Wasatch Formation, alluvium, and clinker) experience a five-feet drawdown would be much smaller than the area of

drawdown in the coal because the shallower aquifers are generally discontinuous, of limited areal extent, and often unconfined.

When the USGS CHIA was prepared, there were about 1,200 water supply wells within the maximum impact area defined in that study. Of those wells, about 580 were completed in Wasatch aquifers, about 100 in the Wyodak coal aquifer, and about 280 in strata below the coal. There were no completion data available for the remainder of the wells (about 240) at the time the USGS CHIA was prepared.

If the South Gillette Area Coal LBA tracts are leased and mined, the groundwater drawdown would be extended into the area surrounding the proposed new leases. When a lease is issued to an existing mine for a maintenance tract, the mine must revise its existing mining permit to include the new tract in its mine and reclamation plans. In order to do that, the lessee would be required to conduct a detailed groundwater analysis to predict the extent of drawdown in the coal and overburden aquifers caused by mining the new lease. WDEQ/LQD would use the revised drawdown predictions to update their cumulative hydrologic impact analysis (WDEQ CHIA) for this portion of the PRB. The applicant has installed monitoring wells that would be used to confirm or refute drawdown predicted by analysis. This analysis would be required as part of the WDEQ mine permitting procedure discussed in sections 1.2 and 1.3.

Potential water-level decline in the subcoal Fort Union Formation is the third major groundwater issue. Water level declines in the Tullock Aquifer have been documented in the Gillette area. According to Crist (1991), these declines are most likely attributable to pumpage for municipal use by Gillette and for use at subdivisions and trailer parks in and near the city of Gillette. Most of the water-level declines in the subcoal Fort Union wells occur within one mile of the pumped wells (Crist 1991, Martin et al. 1988). Many of the mines have water supply wells completed in zones below the coal, but the mine facilities in the PRB are separated by a distance of one mile or more, so little interference between mine supply wells would be expected.

In response to concerns voiced by regulatory personnel, several mines have conducted impact studies of the subcoal Fort Union Formation. The OSM also commissioned a cumulative impact study of the subcoal Fort Union Formation to address the effects of mine facility wells on this aquifer (OSM 1984). Conclusions from these studies are similar and may be summarized as follows:

- Because of the discontinuous nature of the sands in this formation and because most large-yield wells are completed in several different sands, it is difficult to correlate completion intervals between wells.
- In the Gillette area, water levels in this aquifer have probably declined because the City of Gillette and several subdivisions have utilized water from the formation (Crist 1991). (Note: Gillette is mixing Fort Union Formation water with water from wells completed in the Madison

Formation. Also, because drawdown has occurred, some operators are able to dispose of CBNG water by injecting it into the subcoal Fort Union Formation near the City of Gillette.)

- Because large saturated thicknesses are available (locally) in this aquifer unit, generally 500 feet or more, a drawdown of 100 to 200 feet in the vicinity of a pumped well would not dewater the aquifer.

Most of the existing coal mines in the PRB have permits from the Wyoming SEO for subcoal Fort Union Formation water supply wells. Two industrial water supply wells within Belle Ayr Mine's existing permit area (Belle Ayr No. 2 Plant #2 Well) are completed in the Fort Union Formation. The Coal Creek Mine uses two wells (State 16-46-70 and CCFU-17-1) completed in this formation to supply water for human consumption and mining operations. The Caballo Mine uses two wells completed in the sub-coal Fort Union Formation (DW-1 and FTUNION#2) to supply water for human consumption and mining operations. Cordero Rojo Mine uses four wells (Rojo No. 1, Rojo No. 2A, PW-24-1-P, and PW-24-2-P) completed in this formation to supply water for human consumption and mining operations. Locations of Fort Union Formation supply wells for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines are shown on Supplementary Information document figures S1-3, S2-2, S3-3, and S4-3, respectively. Extending the life of the South Gillette Area mines by issuing new leases would result in additional water being withdrawn from the subcoal Fort Union Formation, but no new sub-coal water supply wells would be required. The additional water withdrawal would not be expected to extend the area of water level drawdown over a substantially larger area due to the discontinuous nature of the sands in the Tullock Member and the fact that drawdown and yield reach equilibrium in a well due to recharge effects. Due to the distances separating subcoal Fort Union Formation wells used for mine water supply, these wells have not experienced interference and are not likely to in the future.

Water requirements and sources for proposed power plants are not currently known, however, there are no proposed power plants in the immediate vicinity of the South Gillette Area mines. The Wyoming SEO is discouraging further development of the lower Fort Union Formation aquifers, so the most likely groundwater source for future power plants is the Lance-Fox Hills Aquifer System. This would reduce the chances that the power plants would add to cumulative hydrologic impacts of mining and CBNG production.

The fourth issue of concern with respect to groundwater is the effect of mining on water quality. Specifically, what effect does mining have on the water quality in the surrounding area, and what are the potential water quality problems in the backfill aquifer following mining?

In a regional study of the cumulative impacts of coal mining, the median concentrations of dissolved solids and sulfates were found to be higher in water from backfill aquifers than in water from either the Wasatch Formation overburden or the Wyodak coal aquifer (Martin et al. 1988). This is expected

because blasting and movement of the overburden materials exposes more surface area to water, increasing dissolution of soluble materials, particularly from the overburden materials that were situated above the saturated zone in the premining environment.

One pore volume of water is the volume of water that would be required to saturate the backfill following reclamation. The time required for one pore volume of water to pass through the backfill aquifer is greater than the time required for the postmining groundwater system to reestablish equilibrium. According to the USGS CHIA, estimates of the time required to reestablish equilibrium range from tens to hundreds of years (Martin et al. 1988).

The major current use of water from the aquifers being replaced by the backfill (the Wasatch Formation overburden and Wyodak coal aquifers) is for livestock because these aquifers are typically too high in dissolved solids for domestic use and well yields are typically too low for irrigation (Martin et al. 1988). Chemical analyses of 336 samples collected between 1981 and 1986 from 45 wells completed in backfill aquifers at 10 mines indicated that the quality of water in the backfill will, in general, meet the state standard for livestock use of 5,000 milligrams per liter (mg/L) for total dissolved solids (TDS) when recharge occurs (Martin et al. 1988).

The 2000 annual GAGMO report (Hydro-Engineering 2001a) evaluated samples from 48 backfill wells in 1999 and found that the TDS in 75 percent were less than 5,000 mg/L, TDS in 23 percent were between 5,000 and 10,000 mg/L, and TDS in one well was above 10,000 mg/L. An analysis of about 2,000 samples collected from 95 backfill monitoring wells between 1986 and 2002 found that the water quality in 75 percent of the wells were within the acceptable range for the Wyoming livestock standard, with 25 percent exceeding that standard (Ogle 2004).

WDEQ/LQD calculated a median TDS concentration of 3,293 mg/L for the backfill aquifer in the east-central area of the PRB, which includes the four mines located immediately south of Gillette, based on 1,384 samples (Ogle et al. 2005). These results suggest that the TDS in the backfill aquifer in the middle group of mines meets the requirements for livestock use and is similar to TDS found in the undisturbed Wasatch Formation overburden but typically larger than TDS found in the Wyodak coal aquifer. The GAGMO 25-Year Report (Hydro-Engineering 2007) reported samples collected from 57 backfill monitoring wells, and of the last samples that were collected from those wells in 2005, the TDS concentrations ranged from a low of 656 mg/L at well RW2804 (at the Belle Ayr Mine) to and high of 12,409 mg/L at well SP-4-NA (at the North Antelope Rochelle Mine), with an average of 3,800 mg/L and a median of 3,670 mg/L. WDEQ/LQD calculated a median TDS concentration of 3,670 mg/L based on 869 samples collected from monitoring wells with at least 15 years of data that are completed in the backfill at the three applicant mines included in this analysis, and concluded that the recovered concentrations will be suitable for post-mining land use (Ogle and Calle 2006). The incremental effect on

groundwater quality due to leasing and mining the South Gillette Area Coal LBA tracts would be to increase the total volume of backfill and, thus, the time for equilibrium to reestablish.

The fifth area of concern is the potential for cumulative impacts to groundwater resources due to the proximity of coal mining and CBNG development. The Wyodak coal is being developed by mining and CBNG production in the same general area. Dewatering activities associated with CBNG development have overlapped with and expanded the area of groundwater drawdown in the coal aquifer in the PRB over what would occur due to coal mining development alone, and this would be expected to continue.

Numerical groundwater flow modeling was used to predict the impacts of the cumulative stresses imposed by mining and CBNG development on the Fort Union Formation coal aquifer in the PRB Oil and Gas Project EIS (BLM 2003). Modeling was necessary because of the large areal extent, variability, and cumulative stresses imposed by mining and CBNG development on the Fort Union coal aquifers. Information from earlier studies was incorporated into the modeling effort for this analysis.

As expected, the modeling indicated that the groundwater impacts from CBNG development and surface coal mining would be additive in nature and that the addition of CBNG development would extend the area experiencing a loss in hydraulic head to the west of the mining area. The 20-year GAGMO report stated that drawdowns in all areas have greatly increased due to the water production from the Wyodak coal aquifer by CBNG producers (Hydro-Engineering 2001b).

Drawdowns in the coal caused by CBNG development would be expected to reduce the need for dewatering in advance of mining, which would be beneficial for mining operations. Wells completed in the coal may also experience increased methane emissions in areas of significant aquifer depressurization. There is a potential for conflicts to occur over who (coal mining or CBNG operators) is responsible for replacing or repairing private wells that are adversely affected by the drawdowns; however, the number of potentially affected wells completed in the coal is not large.

As discussed previously, coal companies are required by state and federal law to mitigate any water rights that are interrupted, discontinued, or diminished by coal mining. In response to concerns about the potential impacts of CBNG development on water rights, a group of CBNG operators and local landowners developed a standard water well monitoring and mitigation agreement that can be used on a case-by-case basis as development proceeds. All CBNG operators on federal oil and gas leases are required to offer this water well agreement to the surface landowners (BLM 2003).

After CBNG development and coal mining projects are completed, it will take longer for groundwater levels to recover due to the overlapping drawdown

impacts caused by the dewatering and depressuring of the coal aquifer by both operations.

4.2.4.2 Surface Water

For the PRB Coal Review Task 1B Report, which describes the baseline year (2003) water resource conditions including surface water use and surface water availability, the Wyoming PRB is divided into two major water planning areas: the Powder/Tongue River Basin and the Northeast Wyoming River Basins.

The main rivers in the Powder/Tongue River Basin are the Tongue River and the Powder River. The Powder/Tongue River Basin receives substantial surface water runoff from the Big Horn Mountains, leading to major agricultural development along drainages in the Tongue River and Powder River basins. Reservoirs are used throughout the basin for agricultural water supply and for municipal water supply in the Powder/Tongue River Basin. Water use in the Powder/Tongue River Basin as of 2002 is summarized in table 4-16.

Table 4-16. Water Use as of 2002 in the Powder/Tongue River Basin.

	Dry Year		Normal Year (acre-feet per year)		Wet Year	
Water Use Categories	**Surface Water**	**Ground-water**	**Surface Water**	**Ground-water**	**Surface Water**	**Ground-water**
Agricultural	178,000	200	184,000	200	194,000	300
Municipal	2,700	500	2,700	500	2,700	500
Domestic	---	4,400	---	4,400	---	4,400
Industrial[1]	---	68,000	---	68,000	---	68,000
Recreation			Non-consumptive			
Environmental			Non-consumptive			
Evaporation	11,300	--	11,300	--	11,300	--
Total	**192,000**	**73,100**	**198,000**	**73,100**	**208,000**	**73,200**

[1] Includes conventional oil and gas production water and CBNG production water.
Source: HKM Engineering et al. 2002a

Many of the other major drainages are affected by irrigation practices to the extent that their flows are not natural (HKM Engineering et al. 2002a). Water availability in the major sub-basins of the Powder/Tongue River Basin is summarized in table 4-17. This table presents the amount of surface water in acre-feet that is physically available above and beyond allocated surface water in these drainages. As a result of the Yellowstone River Compact, Wyoming must share some of the physically available surface water in the Powder/Tongue River Basin with Montana.

The Little Bighorn River, Tongue River, Powder River, Crazy Woman Creek, and Piney Creek carry the largest natural flows in the Powder/Tongue River Basin. The main rivers in the Northeast Wyoming River Basins are the Belle Fourche in Campbell and Crook Counties and the Cheyenne River in Converse, Weston, and Niobrara Counties. Water in these rivers and their tributaries comes from groundwater baseline flow and from precipitation, especially from heavy storms

Table 4-17. Surface Water Availability in the Powder/Tongue River Basin.

Sub-basin	Surface Water Availability (acre-feet per year) Wet Years	Normal Years	Dry Years
Little Bighorn River	152,000	113,000	81,000
Tongue River	473,000	326,000	218,000
Clear Creek	213,000	124,000	80,000
Crazy Woman Creek	69,000	32,000	16,000
Powder River	547,000	324,000	16,000
Little Powder River	48,000	12,000	3,000
Total	**1,502,000**	**931,000**	**414,000**

Source: HKM Engineering et al. 2002a

during the summer months. Water use in the Northeast Wyoming River Basins as of 2002 is summarized in table 4-18.

Table 4-18. Water Use as of 2002 in the Northeast Wyoming River Basins.

	Dry Year		Normal Year (acre-feet per year)		Wet Year	
Water Use Categories	**Surface Water**	**Ground-water**	**Surface Water**	**Ground-water**	**Surface Water**	**Ground-water**
Agricultural	65,000	11,000	69,000	17,000	71,000	17,000
Municipal	---	9,100	---	9,100	---	9,100
Domestic	---	3,600	---	3,600	---	3,600
Industrial (Oil and Gas)[1]	---	46,000	---	46,000	---	46,000
Industrial (Other)[2]	---	4,700	---	4,700	---	4,700
Recreation			Non-consumptive			
Environmental			Non-consumptive			
Evaporation (Key Reservoirs)	14,000	---	14,000	---	14,000	---
Evaporation (Stock Ponds)	6,300	---	6,300	---	6,300	---
Total	**85,300**	**74,400**	**89,300**	**80,400**	**91,300**	**80,400**

[1] Includes conventional oil and gas production water and CBNG production water.
[2] Includes electricity generation, coal mining, and oil refining.
Source: HKM Engineering et al. 2002b

Stream flow in the major drainages of the Northeast Wyoming River Basins is much less than in the Powder/Tongue River Basin, due to the absence of a major mountain range to provide snow melt runoff. Water availability in the major sub-basins of the Northeast Wyoming Rivers Basin is summarized in table 4-19.

The portions of the PRB Coal Review Task 3B Report (BLM 2008f) that have been completed evaluate cumulative impacts to surface water quality as a result of CBNG, conventional oil and gas, and surface coal mining development in 2003,

Table 4-19. Surface Water Availability in the Northeast Wyoming River Basins.

Sub-basin	Surface Water Availability (acre-feet per year) Wet Years	Normal Years	Dry Years
Redwater Creek	34,000	26,000	17,000
Beaver Creek	30,000	20,000	14,000
Cheyenne River	103,000	31,000	5,000
Belle Fourche River	151,000	71,000	13,000
Total	**318,000**	**148,000**	**49,000**

Source: HKM Engineering et al. 2002b

and projected development in 2010, 2015, and 2020 in the PRB Coal Review Task 3 study area (figure 4-4). The surface water resources in the PRB Coal Review Task 3 study area consist primarily of intermittent and ephemeral streams and scattered ponds and reservoirs. A major impact of the projected development activities would be direct surface disturbance of these surface water features. Table 4-10 summarizes the cumulative baseline (2003) and projected (in 2010, 2015, and 2020) acres of surface disturbance and reclamation. The projected activities would result in surface disturbance in each of the six Task 3 study area subwatersheds (figure 4-4). Discrete locations for development disturbance and reclamation areas cannot be determined based on existing information. However, the projected disturbance would primarily involve the construction of additional linear facilities, product gathering lines, and road systems associated with conventional oil and gas and CBNG activities, plus additional disturbance associated with extending coal mining operations onto lands adjacent to the existing mines.

Surface disturbing activities can result in sediment input to water bodies, which affects water quality parameters such as turbidity and bottom substrate composition. Contaminants also can be introduced into water bodies through chemical characteristics of the sediment. Studies have shown that TDS levels in streams near reclaimed coal mine areas have increased from 1 percent to 7 percent (Martin et al. 1988). Typically, sedimentation effects are short-term in duration and localized in terms of the affected area. Suspended sediment concentrations would stabilize and return to typical background concentrations after construction or development activities have been completed. It is anticipated that sediment input associated with development disturbance areas would be minimized by implementation of appropriate erosion control measures, as would be determined during future permitting.

Future coal mining could remove intermittent or ephemeral streams and stock ponds in the Little Powder River, Upper Belle Fourche River, Upper Cheyenne River, and Antelope Creek subwatersheds. As discussed in section 3.5.2, the South Gillette Area mines are in the Upper Belle Fourche River subwatershed. Coal mine permits provide for removal of first- through fourth-order drainages. During reclamation, third- and fourth-order drainages must be restored; first- and second-order drainages often are not replaced (Martin et al. 1988).

Coal mining-related surface water would be discharged into intermittent and ephemeral streams in four subwatersheds (Antelope Creek, Little Powder River, Upper Belle Fourche River, and Upper Cheyenne River). Based on current trends, it is assumed that most, if not all, of the coal mine-produced water would be consumed during operation. As discussed in section 3.5.2.2, changes in surface runoff would occur as a result of the destruction and reconstruction of drainage channels as mining progresses. Sediment control structures would be used to manage discharges of surface water from the mine permit areas. State and federal regulations require treatment of surface runoff from mined lands to meet effluent standards.

The PRB Coal Review assumes that future permitting would allow a portion of CBNG-produced water to be discharged to intermittent and ephemeral drainages as is currently allowed in the six subwatersheds in the PRB Coal Review Task 3 study area (figure 4-4). It is estimated that up to 39,108, 41,899, and 37,390 mmgpy of water would be produced in 2010, 2015, and 2020, respectively.

The PRB Coal Review Task 3B surface water quality impact analysis utilizes the surface water model described in the Surface Water Quality Analysis Technical Report (Greystone 2003), which was prepared in support of the PRB Oil and Gas Project EIS (BLM 2003), to evaluate the cumulative impacts to surface water resources from surface discharge of CBNG development. Based on past monitoring in receiving streams, most CBNG discharge water either infiltrates or evaporates within a few miles of the discharge points and generally is not recorded at USGS Stream gauging stations. Impacts to surface water flow and quality are therefore generally limited to within a few miles of the discharge point. In view of this, the PRB Coal Review Task 3B water quality impact analysis assumes a conveyance loss of 70 percent for the water quality assessment and modeling analysis.

Key water quality parameters for predicting the potential effects of CBNG development in the surface water quality impact analysis focused on the suitability of surface water for irrigated agriculture. Sodium adsorption ratio, or SAR, and salinity, measured by electrical conductivity or EC, were utilized for this prediction. Most restrictive proposed limits (MRPL) and least restrictive proposed limits (LRPL) regulatory standards for EC and SAR applicable to the subwatersheds were developed and used in the analysis. The limits presented in table 4-20 were used during the comparison of EC and SAR valued for resulting mixtures of existing streamflows and discharges from CBNG wells under various flow conditions and the CBNG water discharge projections for 2010, 2015, and 2020.

The impacts to water quality on the receiving drainages assumed two hydrologic conditions: dry year conditions and normal year conditions. The impact analysis, conducted using monthly flows, comparatively evaluated the water quality parameters (SAR and EC) of the receiving drainage before and after mixing with discharge water generated by the CBNG wells within that drainage. In general, the water discharged from the CBNG wells reflected increased levels

Table 4-20. Summary of Proposed Limits for SAR and EC.

Subwatershed	Most Restrictive Proposed Limit (MRPL)		Least Restrictive Proposed Limit (LRPL)	
	SAR	EC (µS/cm)	SAR	EC (µS/cm)
Little Powder	5	2,000	9.75	2,500
Powder	2	2,000	9.75	2,500
Belle Fourche	6	2,000	10	2,500
Cheyenne, Antelope Creek	10	2,000	10	2,500

Source: Wyoming DEQ, Montana DEQ, and South Dakota Legislative Council

of SAR and reduced levels of EC compared to the water quality of the receiving drainages. Impacts to water quality are likely to be maximized during the low flow months; consequently, the comparative evaluation of water quality also focused on the minimum monthly flow associated with the dry year and normal year conditions.

The water quality impact analysis made several observations regarding the overall effects of mixing CBNG well production water with surface water in the PRB Coal Review Task 3 study area. These general observations are summarized below.

Before mixing, the surface water in the Upper Powder River exceeds the MRPL for both EC and SAR throughout the majority of the year. Levels of SAR are less than the LRPL while EC values generally exceed the LRPL from July through December. After mixing, a minimal reduction in EC and a minor increase in SAR are projected, which reflects the relatively small contribution of CBNG well production water to the much larger flows in the Upper Powder River. Projected SAR values exceed the MRPL through out the year while meeting the LRPL. Projected EC values exceed the MRPL throughout the majority of the year and the LRPL from July though December.

For Antelope Creek and the Dry Fork Cheyenne River under the before mixing scenario, the SAR values are relatively low and do not exceed the MRPL. The EC values exceed the MRPL during the low-flow months, but are typically less than the LRPL all year. After mixing, SAR levels increase but are projected to continue to meet the MRPL and a reduction in EC is projected that meets the MRPL throughout the year. This is a reflection of the lack of surface water in these streams combined with the relatively low values for EC and SAR in the CBNG well production water.

Before mixing, the surface water in the Little Powder River exceeds the MRPL for EC and SAR throughout the majority of the year. SAR levels remain below the LRPL throughout the year, but EC levels exceed the LRPL during the low flow months. After mixing, the projected SAR values exceed the MRPL throughout the year and exceed the LRPL from one month (in 2003) to five months (in 2010 and 2015) of the year. The projected EC exceeds the MRPL for four months of the year but meets the LRPL throughout the year.

For the Upper Cheyenne River before mixing, the SAR levels do not exceed the MRPL and the EC levels exceed the MRPL for eleven months of the year and the LRPL for nine months of the year. After mixing, the projected SAR levels continue to meet the MRPL throughout the year and the projected EC levels exceed the MRPL for 10 or more months of the year and the LRPL for six or more months of the year.

Before mixing, the surface water in the Upper Belle Fourche River exceeds the MRPL for SAR from November though January while meeting the LRPL throughout the year. The EC levels exceed the MRPL from September through January and exceed the LRPL from November through January. After mixing, the projected SAR values exceed the MRPL six or more months of the year while continuing to meet the LRPL throughout the year. The projected EC values meet the MRPL throughout the year.

The suitability of the mixed water for irrigation purposed is related to EC and SAR. In general, the water most suitable for irrigation has a relatively low SAR and a relatively high EC. Elevated SAR values may reduce permeability in clayey soils, which reduces the rate of water infiltration. As discussed above, the water discharged from the CBNG wells is generally characterized by higher levels of SAR and reduced levels of EC compared to the water quality of the receiving drainages. In those cases where mixing results in a significant increase in SAR and the EC is moderately low, the water was considered unsuitable. For Antelope Creek, the Dry Fork Cheyenne River, the Little Powder River and the Upper Belle Fourche River, the projected water quality after mixing demonstrated adequate suitability for irrigation during normal year conditions and unsuitability for irrigation during some to all of the irrigation season during dry year conditions. In general, for periods where CBNG well production water represents the majority of the flow available for irrigation purposes, there is a reduction in the suitability of the water for irrigation purposes.

4.2.5 Channel Stability

A qualitative assessment of the impacts to receiving drainages resulting from the introduction of CBNG well production water was made. The channel of the Belle Fourche River below Moorcroft would change by less than 0.2%, while the channel of the Little Powder River near Weston would change by less than 0.3% (table 4-21). Given the low increase in mean annual discharge from introduced CBNG water, changes in channel geomorphology (width, depth, gradient, bed material transport and meander wavelength) are considered imperceptible.

Discharge of CBNG well production water into ephemeral drainages may start or exacerbate erosion in the channel. Given the potentially greater increase in ephemeral drainages due to a lower natural flow, channel geomorphology is more likely to be perceptible. Monitoring and mitigation for erosion are included in water management planning for oil and gas drilling approvals. According to the BLM Task 3B Report, a special study was done of the Caballo Creek drainage in the Belle Ayr mine permit area, to see how reclaimed drainages were

Table 4-21. Impact of CBNG Production Water on Perennial Streams.

Location	Channel Forming Discharge [(1)] (cfs)	CBNG Discharge (cfs)	CBNG Discharge (%)	Estimated Width: Existing Conditions (ft)	Estimated Width: Combined Discharge (ft)	Potential Impact [Increased Width] (ft)	Potential Impact [Increased Width] (%)
Little Powder River above Dry Creek near Weston, Wyoming (USGS Gage 06324970)	270 to 420	2.2	0.5% to 0.8%	47.3 to 56.3	47.4 to 56.4	0.15 to 0.12	0.3%
Belle Fourche River below Moorcroft, Wyoming (USGS Gage 06426500)	652 to 789	3.9	0.5% to 0.6%	66.9 to 72.1	67.0 to 72.2	0.16 to 0.14	0.2%

(1) Discharge associated with the 1.5 to 2 year recurrence interval.

impacted by increased CBNG discharges. It was determined that CBNG discharge represented less than 1% of the 2-year peak discharge. No active erosion was noted in the natural or diverted portions of the Caballo Creek channel, while an increase in vegetative diversity and density was noted. The minor amount of flow increase would not likely result in increased erosion in streams similar to Caballo Creek. While it is more likely that creeks with smaller drainage areas, like Duck Nest or Bone Pile Creeks may experience more erosion due to relatively larger flow increases due to CBNG discharge, such effects were not observed in the field (BLM 2008f).

4.2.6 Alluvial Valley Floors

The identified AVFs for all coal mines in the PRB Coal Review study area are described in the PRB Coal Review Task 1D Report (BLM 2005d), based on individual mine State Decision Documents. Regulatory determinations of AVF occurrence and location are completed as part of the permitting process for coal mining operations, because their presence can restrict mining activities under SMCRA and Wyoming laws. The WDEQ/LQD administers the AVF regulations for coal mining activities in Wyoming. Coal mine-related impacts to designated AVFs generally are not permitted if the AVF is determined to be significant to agriculture. If an AVF is determined not to be significant to agriculture or if the permit to affect the AVF was approved prior to the effective date of SMCRA, the AVF can be disturbed during mining but must be restored to essential hydrologic function during reclamation.

The formal AVF designation and related regulatory programs described above are specific to coal mining operations; however, other development-related activities in the study area would potentially impact AVF resources. The portions of the PRB Coal Review Task 3 study area that lie outside of the mine permit areas have generally not been surveyed for the presence of AVFs; therefore, the locations and extent of the AVFs outside of the mine permit areas have not been determined.

4.2.7 Soils

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts to soils as a result of projected development activities in the PRB Coal Review Task 3 study area. The area of surface coal mining disturbance and reclamation for the baseline year (2003) and the projected cumulative areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in tables 4-2 and 4-3. The area of disturbance and reclamation for all development for the baseline year and the projected cumulative total areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in table 4-10.

Development activities such as increased vehicle traffic, vegetation removal, soil salvage and redistribution, discharge of CBNG produced groundwater, and construction and maintenance of project-specific components (e.g., roads, ROWs, well pads, industrial sites, and associated ancillary facilities) would result in cumulative impacts to soils in the study area. In general, soil disturbance and handling from these activities would generate both long-term and short-term impacts to soil resources through accelerated wind or water erosion, declining soil quality factors, compaction, and the removal of soil resources at industrial sites.

Of the types of development projects in the study area, coal mining activities would create the most concentrated cumulative impacts to soils. This is due to the large acreages involved and the tendency of mining operations to occur in contiguous blocks. These factors would encourage widespread accelerated wind and water erosion. Extensive soil handling would cause compaction and a corresponding loss of permeability to water and air; a decline in microbial populations, fertility, and organic matter; and potential mixing of saline and/or alkaline soil zones into seedbeds, which would reduce soil quality. There would be a limited availability of suitable soil resources for reclamation uses in some areas.

However, for surface coal mining operations, there are measures that are either routinely required or can be specifically required as necessary to reduce impacts to soil resources and to identify overburden material that may be unsuitable for use in reestablishing vegetation, as discussed in sections 3.3.1.3, 3.4.2.3, and 3.8.3.

As described in Appendix E of the PRB Coal Review Task 2 Report (BLM 2005a), a variety of CBNG water disposal methods may be employed in the Task 3 study area. The potential impacts to soils would depend on the water treatment method, if any, and the nature of the disposal method. As discussed in the PRB Coal Review Task 3D Report (BLM 2005f), due to elevated SAR levels in water produced from the Wyodak-Anderson coal zone in the Upper Powder River and Little Powder River subwatersheds, land applications of CBNG-produced water in those areas could increase soil alkalinity. As discussed above in section 4.2.4.2, the SAR values are generally low for the Upper Belle Fourche subwatershed and tend to exceed the MRPL after mixing with discharged CBNG

water during six months of the year while meeting the LRPL throughout the year. Land application of CBNG-produced water is not anticipated in this area. The specific approaches to CBNG water discharges, the resource conditions and locations in which they occur, the timing of discharges, and the discharge permit stipulations from regulatory and land management agencies would determine the extent and degree of potential impacts to soils.

4.2.8 Vegetation, Wetlands and Riparian Areas

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts to vegetation, wetlands, and riparian areas as a result of projected development activities in the PRB Coal Review Task 3 study area. The area of surface coal mining disturbance and reclamation for the baseline year (2003) and the projected cumulative areas of disturbance and reclamation for 2010, 2015, and 2020 related to surface coal mining are shown in tables 4-2 and 4-3. For all projected development, the baseline year area of disturbance and reclamation and the projected cumulative total areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in table 4-10.

4.2.8.1 Vegetation

The PRB is characterized as a mosaic of general vegetation types, which include prairie grasslands, shrublands, forested areas, and riparian areas. These broad categories often represent several vegetation types that are similar in terms of dominant species and ecological importance. Fourteen vegetation types were identified within the PRB Coal Review Task 1 study area, of which 10 primarily consist of native vegetation and are collectively classified as rangeland. These vegetation types include short-grass prairie, mixed-grass prairie, sagebrush shrubland, other shrubland, coniferous forest, aspen, forested riparian, shrubby riparian, herbaceous riparian, and wet meadow. The remaining vegetation types support limited or non-native vegetation and include cropland, urban/disturbed, barren, and open water. The vegetation types are described in more detail in the Task 1D Report for the PRB Coal Review (BLM 2005d).

Impacts to vegetation can be classified as short-term and long-term. Potential short-term impacts arise from the removal and disturbance of herbaceous species during a project's development and operation (e.g., coal mining, CBNG drilling and production, etc.), which would cease upon project completion and successful reclamation in a given area. Reclaimed mine land is defined by WDEQ/LQD as affected land that has been backfilled, graded, topsoiled, and permanently seeded in accordance with the approved practices specified in the reclamation plan (Christensen 2002). Species composition on the reclaimed lands may be different than on the surrounding undisturbed lands. The removal of woody species would be considered a long-term impact since these species take approximately 25 years or longer to attain a size comparable to woody species present within proposed disturbance areas. Potential long-term impacts would also include permanent loss of vegetation and vegetative

productivity in areas that would not be reclaimed in the near term (e.g., power plant sites, etc.).

4.2.8.2 Special Status Plant Species

Special status plant species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed and federally proposed species (species that are protected under the ESA), BLM Sensitive Species, U.S. Department of Agriculture – Forest Service (USFS) Sensitive Species, and Wyoming Game and Fish Department (WGFD) Species of Special Concern in Wyoming. There are no USFS administered lands within the four LBA tracts. Further discussions of species that are protected under the ESA, as well as BLM Sensitive Species, are included in Appendices E and F of this EIS. One federally listed species (Ute ladies'-tresses orchid) and three USFS sensitive species (Barr's milkvetch, Rosy palafox, and Lemonscent) are known to occur in the PRB Coal Review Task 3 study area. Three BLM sensitive species [Nelson's milkvetch and Laramie columbine (Casper Field Office) and William's wafer-parsnip (Buffalo Field Office) may occur in the PRB Coal Review Task 3 study area.

Potential direct impacts to special status plant species in the study area could include the incremental loss or alteration of potential or known habitat, associated with past and projected activities. Direct impacts also could include the direct loss of individual plants within the PRB Coal Review Task 3 study area, depending on their location in relation to development activities. Indirect impacts could occur due to increased dispersal and establishment of noxious weeds, which may result in the displacement of special status plant species in the long term.

4.2.8.3 Noxious and Invasive Weed Species

Once established, invasive and non-native plant species can out-compete and eventually replace native species, thereby reducing forage productivity and the overall vigor and diversity of existing native plant communities. The state of Wyoming has currently designated the following 25 plant species as noxious weeds:

- Field bindweed (*Convolvulus arvensis*)
- Canada thistle (*Cirsium arvense*)
- Leafy spurge (*Euphorbia esula*)
- Perennial sowthistle (*Sonchus arvensis*)
- Quackgrass (*Agropyron repens*)
- Hoary cress (*Cardaria draba*)
- Perennial pepperweed (giant whitetop) (*Lepidium latifolium*)
- Ox-eye daisy (*Chrysanthemum leucanthemum*)
- Skeletonleaf bursage (*Franseria discolor Nutt.*)
- Russian knapweed (*Centaurea repens L.*)
- Yellow toadflax (*Linaria vulgaris*)

- Dalmatian toadflax (*Linaria dalmatica*)
- Scotch thistle (*Onopordum acanthium*)
- Musk thistle (*Carduus nutans*)
- Common burdock (*Arctium minus*)
- Plumeless thistle (*Carduus acanthoides*)
- Dyers woad (*Isatis tinctoria*)
- Houndstongue (*Cynoglossum officinale*)
- Spotted knapweed (*Centaurea maculosa Lam.*)
- Diffuse knapweed (*Centaurea diffusa Lam.*)
- Purple loosestrife (*Lythrum salicaria L.*)
- Saltcedar (*Tamarix spp.*)
- Common St. Johnswort (*Hypericum perforatum*)
- Common Tansy (*Tanacetum vulgare*)
- Russian olive (Elaeagnus angustifolia L.)

Campbell County does not have a declared list of weeds

Development-related construction and operation activities would potentially result in the dispersal of noxious and invasive weed species within and beyond the surface disturbance boundaries, which would result in the displacement of native species and changes in species composition in the long term. The potential for these impacts would be higher in relation to the development of linear facilities (e.g., pipeline ROWs, oil- and gas-related road systems, etc.) than for site facilities (e.g., mines, power plants, etc.) due to the potential for dispersal of noxious weeds over a larger area.

Chapter 4, Section 2(d)(xiv) of the WDEQ/LQD rules and regulations requires that surface coal mines address weed control on reclaimed areas as follows:

> The operator must control and minimize the introduction of noxious weeds in accordance with Federal and State requirements until bond release.

Accordingly, the reclamation plans for all surface coal mines in the Wyoming PRB include steps to control invasion by weedy (invasive nonnative) plant species. As discussed in chapter 3, section 3.9.4, the South Gillette Area mines work with the Campbell County Weed and Pest Department and conduct an active noxious weed control program on their existing coal leases. Similar measures to identify and control noxious weeds are used at all of the surface coal mines in the Wyoming PRB as a result of the WDEQ/LQD regulatory requirements.

Mitigation to control invasion by noxious weeds for CBNG developers is determined on a site-specific basis and may include spraying herbicides before entering areas and washing vehicles before leaving infested areas. BLM reviews weed educational material during preconstruction on-site meetings with CBNG operators, subcontractors, and landowners. BLM also attaches this educational information to approved Applications for Permit to Drill (APDs) or Plans of

Development (PODs) (BLM 2003). BLM also participates in a collaborative effort with the South Goshen Cooperative Extension Conservation District, the USDA-Natural Resources Conservation Service (NRCS), private surface owners, WGFD, and the Weed and Pest District in a prevention program that includes a long-term integrated weed management plan, public awareness and prevention programs, and a common inventory (BLM 2003).

4.2.8.4 Wetland and Riparian Species

Operations associated with development activities in the study area would result in the use of groundwater. Annually, during 2010-2020, from 30,000-35,000 mmgpy of CBNG-produced water would be discharged to impoundments or intermittent and ephemeral streams or reinjected. The discharge of produced water could result in the creation of wetlands in containment ponds, landscape depressions, and riparian areas along segments of drainages that previously supported upland vegetation. In addition, existing wetlands and riparian areas that would receive additional water would become more extensive and potentially support a greater diversity of wetland species in the long term. Alternately, the discharge of abnormally high flows or water with SARs of 13 or more could impact existing vegetation as discussed in the Task 1D Report for the PRB Coal Review (BLM 2005d). For agricultural uses, the current Wyoming water quality standard for SAR is 8.0 (WDEQ/WQD 2005). SARs of 5 to 10 have been observed in discharge waters in the study area (BLM 2003). Once water discharges have peaked and subsequently decrease in the long term, the extent of wetlands and riparian areas and species diversity would decrease accordingly. After the complete cessation of water discharges, artificially-created wetland and riparian areas once again would support upland species and previously existing wetland and riparian areas would decrease in areal extent.

4.2.9 Wildlife and Fisheries

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts to wildlife as a result of projected development activities in the PRB Coal Review Task 3 study area. The area of habitat disturbance and reclamation related to surface coal mining for the baseline year (2003) and the projected cumulative areas of habitat disturbance and reclamation for 2010, 2015, and 2020 are shown in tables 4-2 and 4-3. The baseline year area of total habitat disturbance and reclamation and the projected cumulative total areas of habitat disturbance and reclamation for 2010, 2015, and 2020 are shown in table 4-10.

Impacts to wildlife can be classified as short-term and long-term. Potential short-term impacts arise from habitat disturbance associated with a project's development and operation (e.g., coal mines, CBNG wells, etc.) and would cease upon project completion and successful reclamation in a given area. Potential long-term impacts consist of long-term or permanent changes to habitats and the wildlife populations that depend on those habitats, irrespective of reclamation success, and habitat disturbance related to longer term projects

(e.g., power plant facilities, rail lines, etc.). Direct impacts to wildlife populations as a result of development activities in the study area could include direct mortalities, habitat loss or alteration, habitat fragmentation, or animal displacement. Indirect impacts could include increased noise, additional human presence, and the potential for increased vehicle-related mortalities.

Habitat fragmentation from activities such as roads, well pads, mines, pipelines, and electrical power lines also can result in the direct loss of potential wildlife habitat. Other habitat fragmentation effects such as increased noise, elevated human presence, dispersal of noxious and invasive weed species, and dust deposition from unpaved road traffic can extend beyond the surface disturbance boundaries. These effects result in overall changes in habitat quality, habitat loss, increased animal displacement, reductions in local wildlife populations, and changes in species composition. However, the severity of these effects on terrestrial wildlife would depend on factors such as sensitivity of the species, seasonal use, type and timing of project activities, and physical parameters (e.g., topography, cover, forage, and climate).

4.2.9.1 Game Species

Big game species that are present within the Task 3 study area include pronghorn, white-tailed deer, mule deer, and elk. Potential direct impacts to these species would include the incremental loss or alteration of potential forage and ground cover associated with construction and operation of the past, present and reasonably foreseeable future development discussed in section 4.1. Development associated with coal mining, drilling for CBNG, ancillary facilities, agricultural operations, urban areas, and transportation and utility corridors result in vegetation removal. Assuming that adjacent habitats would be at or near carrying capacity and considering the variabilities associated with drought conditions and human activities in the study area, the PRB Coal Review Task 3D study concluded that displacement of wildlife species (e.g., big game) as a result of development activities would create some unquantifiable reduction in wildlife populations.

There are a number of big game habitat ranges within the PRB Coal Review Task 3 study area. In Wyoming, the WGFD and the BLM have established habitat classifications based on seasonal use. Classification types include crucial winter, severe winter, winter yearlong, and yearlong. Crucial winter range areas are considered essential in determining a game population's ability to maintain itself at a certain level over the long term. As discussed in the PRB Coal Review Task 2 Report, discrete locations for most of the disturbance related to the projected development could not be determined based on the available information. However, identified future coal reserves were used for the Task 3D Report to provide some level of quantification of potential future impacts to big game ranges. Tables 4-22 through 4-25 summarize the effects on pronghorn, deer, and elk game ranges as a result of the predicted lower and upper levels of coal production through 2020.

Table 4-22. Potential Cumulative Disturbance to Pronghorn Ranges from Development Activities—Lower and Upper Coal Production Scenarios (acres/percent affected).

Time Period/Scenario	Pronghorn Ranges[1] Crucial Winter	Severe Winter	Winter Yearlong	Yearlong
2010/Lower	N/A	1,472 / 3%	33,196 / 2%	32,099 / 1%
2010/Upper	N/A	1,472 / 3%	34,760 / 2%	33,172 / 1%
2015/Lower	N/A	1,460 / 3%	32,649 / 2%	34,828 / 1%
2015 Upper	N/A	1,460 / 3%	34,177 / 2%	36,999 / 1%
2020/Lower	N/A	1,422 / 3%	33,637 / 2%	35,714 / 1%
2020/Upper	N/A	1,422 / 3%	33,580 / 2%	37,437 / 2%

[1] Potential coal mine related impacts to big game ranges were determined based on GIS information as follows: the total acres of a big game range (e.g., crucial winter, severe winter, winter yearlong, and yearlong) within the PRB Coal Review Task 3 study area was divided by the sum of the potential disturbance acreage for the time period (based on GIS mapping of coal reserves for the lower coal production scenario) and existing (2003) disturbance from coal mine development.
Source: PRB Coal Review Task 3D Report (BLM 2005f)

Table 4-23. Potential Cumulative Disturbance to White-tailed Deer Ranges from Development Activities—Lower and Upper Coal Production Scenarios (acres/percent affected).

Time Period/Scenario	White-tailed Deer Ranges[1] Crucial Winter	Severe Winter	Winter Yearlong	Yearlong
2010/Lower	N/A	N/A	N/A	1,411 / 0.6%
2010/Upper	N/A	N/A	N/A	1,411 / 0.6%
2015/Lower	N/A	N/A	N/A	1,497 / 0.7%
2015 Upper	N/A	N/A	N/A	1,495 / 0.7%
2020/Lower	N/A	N/A	N/A	1,704 / 0.7%
2020/Upper	N/A	N/A	N/A	1,707 / 0.8%

[1] Potential coal mine-related impacts to big game ranges were determined based on GIS information as follows: the total acres of a big game range (e.g., crucial winter, severe winter, winter yearlong, and yearlong) within the PRB Coal Review Task 3 study area was divided by the sum of the potential disturbance acreage for the time period (based on GIS mapping of coal reserves for the lower coal production scenario) and existing (2003) disturbance from coal mine development.
Source: PRB Coal Review Task 3D Report (BLM 2005f)

Table 4-24. Potential Cumulative Disturbance to Mule Deer Ranges from Development Activities—Lower and Upper Coal Production Scenarios (acres/percent affected).

Time Period/Scenario	Mule Deer Ranges[1] Crucial Winter	Severe Winter	Winter Yearlong	Yearlong
2010/Lower	N/A	N/A	6,808 / 0.4%	25,390 / 1%
2010/Upper	N/A	N/A	6,924 / 0.4%	26,641 / 1%
2015/Lower	N/A	N/A	6,956 / 0.4%	26,420 / 1%
2015 Upper	N/A	N/A	7,285 / 0.5%	27,205 / 1%
2020/Lower	N/A	N/A	6,958 / 0.4%	27,004 / 1%
2020/Upper	N/A	N/A	7,413 / 0.5%	27,990 / 1%

[1] Potential coal mine-related impacts to big game ranges were determined based on GIS information as follows: the total acres of a big game range (e.g., crucial winter, severe winter, winter yearlong, and yearlong) within the PRB Coal Review Task 3 study area was divided by the sum of the potential disturbance acreage for the time period (based on GIS mapping of coal reserves for the lower coal production scenario) and existing (2003) disturbance from coal mine development.
Source: PRB Coal Review Task 3D Report (BLM 2005f)

Table 4-25. Potential Cumulative Disturbance to Elk Ranges from Development Activities—Lower and Upper Coal Production Scenarios (acres/percent affected).

Time Period/Scenario	Elk Ranges[1] Crucial Winter	Severe Winter	Winter Yearlong	Yearlong
2010/Lower	24 / 0.4%	N/A	375 / 1%	1,444 / 0.9%
2010/Upper	24 / 0.4%	N/A	375 / 1%	1,444 / 0.9%
2015/Lower	24 / 0.4%	N/A	351 / 1%	1,161 / 0.7%
2015 Upper	24 / 0.4%	N/A	351 / 1%	1,162 / 0.7%
2020/Lower	24 / 0.4%	N/A	351 / 1%	1,121 / 0.7%
2020/Upper	24 / 0.4%	N/A	351 / 1%	1,168 / 0.7%

[1] Potential coal mine-related impacts to big game ranges were determined based on GIS information as follows: the total acres of a big game range (e.g., crucial winter, severe winter, winter yearlong, and yearlong) within the PRB Coal Review Task 3 study area was divided by the sum of the potential disturbance acreage for the time period (based on GIS mapping of coal reserves for the lower coal production scenario) and existing (2003) disturbance from coal mine development.

Source: PRB Coal Review Task 3D Report (BLM 2005f)

Direct and indirect effects to small game species (i.e., upland game birds, waterfowl, small game mammals) within the Task 3 study area as a result of development activities would be the same as discussed above for big game species. Impacts would result from the incremental surface disturbance of potential wildlife habitat, increased noise levels and human presence, dispersal of noxious and invasive weed species, and dust effects from unpaved road traffic.

Operations associated with development activities in the Task 3 study area would result in the use of groundwater. The PRB Coal Review assumes that most, if not all, of the coal mine-produced water would be consumed during operation and anticipates that up to approximately 39,108, 41,484, and 37,350 mmgpy of water would be produced in association with oil and gas production in 2010, 2015, and 2020, respectively. The portion of the water that is produced in association with the CBNG and discharged to impoundments or intermittent and ephemeral streams would be available for area wildlife (e.g., waterfowl). Although much of the water would evaporate or infiltrate into the ground, it is anticipated that substantial quantities of water would remain on the surface and would result in the expansion of wetlands, stock ponds, and reservoirs, potentially increasing waterfowl breeding and foraging habitats. The median sodium concentration of CBNG-produced water from the Fort Union Formation is 270 mg/L. If sodium concentrations are maintained below 17,000 mg/L in the evaporation ponds, the potential adverse effects to waterfowl would be minimal.

4.2.9.2 Non-game Species

Potential direct impacts to non-game species (e.g., small mammals, raptors, passerines, amphibians, and reptiles) would include the incremental loss or alteration of existing or potential foraging and breeding habitats from construction and operation of past, present and reasonably foreseeable future development activities (e.g., vegetation removal for coal mines and CBNG wells, ancillary facilities, and transportation and utility corridors). Impacts also could

result in mortalities of less mobile species (e.g., small mammals, reptiles, amphibians, and invertebrates), nest or burrow abandonment, and loss of eggs or young in the path of vehicles and heavy equipment. Indirect impacts would include increased noise levels and human presence, dispersal and invasion of noxious weeds, and dust effects from unpaved road traffic. Assuming that adjacent habitats would be at or near carrying capacity, and considering variable factors such as drought conditions and human activities in the study area, the PRB Coal Review concluded that displacement of wildlife species from the Task 3 study area would result in an unquantifiable reduction in wildlife populations.

Numerous migratory bird species have been documented within the PRB over the last two to three decades of wildlife monitoring. Development activities that occur during the migratory bird breeding season (April 1 through July 31) could cause the abandonment of a nest site or territory or the loss of eggs or young, resulting in the loss of productivity for the breeding season. Loss of an active nest site, incubating adults, eggs, or young would not comply with the intent of the Migratory Bird Treaty Act and could potentially affect populations of important migratory bird species that may occur in the PRB.

Breeding raptor species that occur within the Task 3 study area include the bald eagle, golden eagle, ferruginous hawk, red-tailed hawk, rough-legged hawk, Swainson's hawk, American kestrel, prairie falcon, northern harrier, great horned owl, short-eared owl, burrowing owl, and long-eared owl (*Asio otus*). Bald eagles and long-eared owls are rare nesters in the area.

One potential direct impact to raptors is habitat (nesting and foraging) loss due to additional surface disturbance within the Task 3 study area. In the event that development activities were to occur during the breeding season (February 1 through July 31), these activities could result in nest or territory abandonment, or loss of eggs or young. Such losses would reduce productivity for the affected species during that breeding season. As discussed above, loss of an active nest site, incubating adults, eggs, or young would not comply with the intent of several laws, including the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Additional direct impacts could result from construction of new overhead power lines in the region. New power line segments in the study area would incrementally increase the collision and/or electrocution potential for migrating and foraging bird species (e.g., raptors and waterfowl) (APLIC 1994). However, the potential for avian collisions with overhead power lines is typically dependent on variables such as the location of the structures relative to high-use areas (e.g., nesting, foraging, staging, and roosting habitats), the orientation of the power line to flight patterns and movement corridors, species composition, line visibility, and structure design.

In addition, new power lines could pose an electrocution hazard for raptor species attempting to perch on the structure. Configurations greater than 69 kV

typically do not present an electrocution potential, based on conductor placement and orientation (APLIC 2006). It is assumed that future permitting for power lines would require the use of appropriate raptor-deterring designs, thereby minimizing potential impacts. For example, SMCRA requires that surface coal mine operators use the best technology available to ensure that electric power lines are designed and constructed to minimize electrocution hazards to raptors. Power line impacts to raptors can be reduced with the increased use of underground power lines wherever possible. Many of the power lines for CBNG development currently are being constructed underground.

4.2.9.3 Fisheries

Potential cumulative effects on fisheries as a result of development activities in the Task 3 study area would be closely related to impacts on ground and surface water resources. In general, development activities could affect fish species in the following ways: 1) alteration or loss of habitat as a result of surface disturbance; 2) changes in water quality as a result of surface disturbance or introduction of contaminants into drainages; and 3) changes in available habitat as a result of water withdrawals or discharge. The potential effects of development activities on aquatic communities are discussed below for each of these impact topics.

The predominant aquatic habitat type in the Task 3 study area consists of intermittent and ephemeral streams and scattered ponds and reservoirs. In general, perennial streams within the study area are limited to the Little Powder River and Belle Fourche River. Warm water game fish and non-game species are present in some perennial stream segments and numerous scattered reservoirs and ponds. However, the latter features are typically stocked artificially either following construction or annually, depending on the depth of the water body. Due to the lack of constant water in most of the potentially affected streams and static water bodies, existing aquatic communities are mainly limited to invertebrates and algae that can persist in these types of habitats. The removal of stock ponds would eliminate habitat for invertebrates and possibly fish species. This loss would be temporary if the stock ponds are replaced during reclamation.

Development activities could result in the loss of aquatic habitat as a result of direct surface disturbance. Table 4-10 summarizes the cumulative acres of surface disturbance and reclamation as of 2003 and projects cumulative acres of surface disturbance and reclamation in 2010, 2015, and 2020. Discrete locations for development disturbance and reclamation areas cannot be determined based on existing information. However, projected development that could result in the loss of aquatic habitat would involve the construction of additional linear facilities, product gathering lines and road systems associated with conventional oil and gas and CBNG activities, as well as any additional disturbance that would be associated with extending coal mine operations onto lands adjacent to the existing mines. The removal of aquatic habitat eliminates existing and potential habitat for invertebrates and some fish species. This loss

would be temporary if such ponds are reconstructed and recharged as part of the reclamation process.

Projected activities would result in surface disturbance in each of the six Task 3 study area sub-watersheds. Information relative to the stream crossing locations for the majority of the linear facilities is not available at this time. The initial phases of the proposed Bison Pipeline project commenced in April 2008 and is projected to be completed by November 2010. If the project is constructed as planned, it would cross Cottonwood Creek, a tributary of the Little Powder River. Typically, the associated disturbance corridor would consist of a 100-foot-wide construction ROW; however, site-specific stream crossing methods and reclamation would be determined at the time of project permitting.

Future coal mining also could remove intermittent or ephemeral streams and stock ponds in the Antelope Creek, Upper Cheyenne River, Upper Belle Fourche River, and Little Powder River sub-watersheds. Coal mine permits provide for removal of first- through fourth-order drainages. During reclamation, third- and fourth-order drainages must be restored; first- and second-order drainages often are not replaced (Martin et al. 1988). As discussed in section 3.5.2, The Upper Belle Fourche River and its tributaries drain the existing South Gillette Area mine permit areas and the LBA tracts. All streams within and adjacent to the tracts are typical for the region, in that flow events are ephemeral. Under natural conditions, aquatic habitat is limited by the ephemeral nature of surface waters in the general South Gillette analysis area. The results of fish surveys conducted in the Belle Fourche River, Caballo Creek, and various area stock ponds during baseline studies for the mines that started in the mid1970s were discussed in section 3.10.7.1; no uncommon species were documented during those efforts.

The PRB Coal Review assumes that surface disturbing activities would not be allowed in perennial stream segments or reservoirs on public lands that contain game fish species. It also assumes that other types of development operations would not occur within stream channels nor would they remove ponds or reservoirs as part of construction or operation and, therefore, would not result in the direct loss of habitat for these species.

Water quality parameters such as turbidity and bottom substrate composition can be impacted by surface disturbing activities through erosion of sediment into water bodies. Contaminants can also be introduced into those systems through the chemical characteristics of the eroded sediment. Potential related effects on aquatic biota could include physiological stress, movement to avoid affected areas, or alterations of spawning or rearing areas (Waters 1995). Studies have shown that TDS levels in streams near reclaimed coal lands have increased from 1 percent to 7 percent (Martin et al. 1988). Typically, sedimentation effects are short-term in duration and localized in terms of the affected area. TDS concentrations would stabilize and return to more typical concentrations after construction or development activities have been completed. The PRB Coal Review anticipated that the use of appropriate erosion and spill

control measures during both development and reclamation activities, as determined during the permitting process, would minimize the introduction of additional sediments into the sub-watershed.

The removal of streamside vegetation would impact both riparian vegetation and stream parameters in those locations. Loss of vegetation along stream channels would reduce the shade and increase bank erosion, both of which would degrade aquatic habitats. Effects on aquatic habitats from linear projects, such as ROWs, would be limited to a relatively small portion of the stream (generally no more than 100 feet in width), whereas mine-related disturbance could affect considerably larger stretches. Because perennial streams are protected from development by a buffer zone on either side of center, these types of impacts would presumably be limited to intermittent and ephemeral creeks. It is anticipated that reclamation practices to restore riparian vegetation would be required during future project permitting, thereby minimizing such impacts.

CBNG and coal mining are the primary types of development activities that use or manage water as part of their operations. Based on current trends, the PRB Coal Review assumes that most, if not all, of the water produced during coal mining would be consumed during operation. As discussed in section 3.5.2.2, changes in surface runoff characteristics and sediment discharges would occur during surface coal mining as a result of the destruction and reconstruction of drainage channels as mining progresses, and the use of sediment control structures to manage discharges of surface water from the mine permit area. State and federal regulations require treatment of surface runoff from mined lands to meet effluent standards. After treatment, coal mine-related surface water in the region would ultimately be discharged into intermittent and ephemeral streams in four sub-watersheds (Antelope Creek, Upper Cheyenne River, Belle Fourche River, and Little Powder River). The PRB Coal Review projects that up to approximately 39,108, 41,484, and 37,350 million gallons per year (mmgpy) of water would be produced in association with oil and gas production in 2010, 2015, and 2020, respectively, and assumes that a portion of the water that is produced in association with the CBNG would be discharged to intermittent and ephemeral drainages in the general analysis area, much as is currently allowed in the six sub-watersheds in the study area. Based on past monitoring in receiving streams, no change in surface flows would be expected beyond approximately two miles from the discharge points (BLM 2003). Water discharged from CBNG wells has supplied some drainages and water bodies in the PRB nearly continuously for several years. Within the general analysis area, Spring Creek has experienced an influx of CBNG water in recent years, but has not become perennial. The same is true for other streams elsewhere in the PRB that receive CBNG discharge water.

4.2.9.4 Special Status Species

Special status species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed and federally proposed species (species that are

protected under the Endangered Species Act [ESA]), BLM Sensitive Species, USFS Sensitive Species, and WGFD Species of Special Concern in Wyoming. There are no USFS administered lands within any of the four LBA tracts. Further discussions of species that are protected under the ESA, as well as BLM Sensitive Species, are included in Appendices E and F of this EIS document. The USFWS also has a list of Migratory Bird Species of Management Concern in Wyoming, which is discussed in section 3.10.6. Special status species potentially occurring in the Task 1 study area are identified in Section 2.4.3.5 of the PRB Coal Review Task 1D Report (BLM 2005d). Additional information about the occurrence of these species in the general analysis area can be found in the Annual Wildlife Reports for the four South Gillette Area mines, on file with the Cheyenne, Wyoming office of the WDEQ/LQD.

Potential impacts to special status terrestrial species would be similar to those discussed above for non-game wildlife (e.g., small mammals, birds, amphibians, and reptiles). Potential direct impacts would include the incremental loss or alteration of potential habitat (native vegetation and previously disturbed vegetation) from construction and operation of development activities (e.g., vegetation removal for coal mines and CBNG wells, ancillary facilities, and transportation and utility corridors). Impacts could also result in mortalities of less mobile species (e.g., small mammals, reptiles, and amphibians), nest or burrow abandonment, and loss of eggs or young in the path of vehicles and heavy equipment. Indirect impacts would include increased noise levels and human presence, introduction and dispersal of noxious weeds, and dust effects from unpaved road traffic.

In general, direct and indirect impacts to special status species would result in a reduction in habitat suitability and overall carrying capacity for species currently inhabiting the PRB Coal Review Task 3 study area. Development within potential habitat for special status species likely would decrease its overall suitability, and potentially would reduce or preclude use by some species due to increased activity and noise. Future use by a special status species of habitats subject to development would be strongly influenced by the quality and composition of remaining habitat, with the degree of impact dependent on variables such as breeding phenology, nest and den site preferences, the species' relative sensitivity to disturbance, and possibly the presence of visual barriers (e.g., topographic shielding) between nesting efforts and disturbance activities.

Bird species that have been identified as occurring within the PRB and are on two or more of the special status species lists include common loon, American bittern, white-faced ibis, trumpeter swan, greater sandhill crane, mountain plover, upland sandpiper, long-billed curlew, black tern, yellow-billed cuckoo, Lewis' woodpecker, pygmy nuthatch, sage thrasher, loggerhead shrike, Baird's sparrow, sage sparrow, Brewers sparrow, and greater sage-grouse. Any development activities (oil and gas, coal mining, other operations and associated infrastructure) that occur during the breeding season (April 1 through July 31) could result in the abandonment of a nest site or territory, or the loss of eggs or young. As discussed previously, loss of an active nest site, incubating adults,

eggs, or young as a result of any of these development activities would not comply with the intent of the Migratory Bird Treaty Act and could potentially impact populations of important migratory bird species that are known to or may occur in the PRB.

A number of raptor species have been documented in the PRB and are on two or more of the special status species lists including bald eagle, ferruginous hawk, northern goshawk, merlin, peregrine falcon, western burrowing owl, and short-eared owl. Those species that have been documented in the general South Gillette general analysis area are discussed at length in Appendices H and I of this EIS. Potential direct impacts to raptors would result from the surface disturbance of nesting and foraging habitat, as well as injury or mortalities due to collisions with vehicles and equipment. Breeding raptors in or adjacent to development activities could abandon their nest sites or territories, or lose eggs or young. As previously described, such losses would constitute non-compliance with the intent of several laws including the Migratory Bird Treaty Act, and the Bald and Golden Eagle Protection Act, and could potentially affect populations of important migratory bird species that are known to or may occur within the region. Incremental construction of new overhead power lines in the area to support energy industries would increase risks of electrocution and collision for perching, migrating, and foraging bird species such as the larger raptors. Use of current APLIC guidelines for construction designs and retrofitting measures for new and existing utility structures would help mitigate these impacts.

A total of 239 greater sage-grouse strutting grounds (leks) were identified in the six sub-watersheds in the PRB Coal Review Task 3 study area as of 2003, though that study did not evaluate the status (i.e., active or inactive) of those leks. As discussed in section 3.10.5 and in the PRB Coal Review Task 1D Report, the trend in the sage-grouse population for the Sheridan Region suggests about a 10-year cycle with periodic highs and lows. More recent population peaks have been lower than previous highs, suggesting a steadily declining sage-grouse population with the Sheridan Region (Oedekoven 2001). Direct and indirect impacts to sage-grouse as a result of development activities would result from the incremental surface disturbance of existing and potential habitat, increased levels of noise and human presence, introduction or dispersal of noxious and invasive weed species, and effects of dust from increased traffic on unpaved roads. In addition to disturbance-related impacts, sage-grouse are susceptible to infection with West Nile Virus, and the incidence of infection is much higher in northeastern Wyoming than the rest of the state.

Eighteen known or potential sage-grouse leks have been identified in the combined evaluation area for the four LBA tracts analyzed in this EIS. Five of those 18 sites are classified by the WGFD as historical, and 5 others have been largely inactive over the last 10-12 years. The eight leks with the most recent activity are all more than 2 miles from the specific wildlife general analysis area of each LBA tract. If the LBA tracts and/or added lands are leased and mined, potential nesting habitat for grouse that were bred at those leks would be

affected by mining activity in those areas. However, as discussed in section 3.10.5.2, no sage-grouse nests or broods have been recorded on any of the four LBA tracts as applied for or on lands added under each respective Alternative 2, during specific surveys or incidental to other wildlife surveys conducted in those areas annually since at least 1994. The noise associated with mining operations may also disrupt sage-grouse breeding and nesting activities that might occur in those areas. Direct and indirect effects to greater sage-grouse within the general South Gillette analysis area as a result of development activities are outlined in appendix I of this EIS.

Based on existing information, the spatial relationship between projected future disturbance and reclamation areas for the coal production scenarios and the resource-specific information in the Geographic Information Systems (GIS) layers could not be determined for the PRB Coal Review. However, the analysis did use GIS layers for future coal reserves to provide some quantification of potential future coal mining-related impacts to greater sage-grouse. The results of this analysis are summarized in table 4-26. The difference in the number of lek sites that would occur within two miles of coal mining activities under the lower coal production scenario versus the upper coal production scenario is due to slight variations in the projected disturbance areas. An unquantifiable number of lek sites initially could be impacted by CBNG activity, which would occur in advance of coal mine development. Potential direct impacts to sage-grouse, if present, could include loss of foraging areas, abandonment of a lek site, or loss of eggs or young as a result of development activities.

Table 4-26. Potential Cumulative Impacts to Greater Sage-grouse Leks from Coal Mine Development - Upper and Lower Coal Production Scenarios.

Lek Categories	2010/ Lower	2010/ Upper	2015/ Lower	2015/ Upper	2020/ Lower	2020/ Upper
Number of Directly Affected Leks	10	10	15	15	15	15
Number of Leks within Two Miles of Coal Mining Activity	47	47	47	49	50	49

Source: PRB Coal Review Task 3D Report (BLM 2005f)

Seven special status fish species potentially occur in the PRB Coal Review Task 3 study area sub-watersheds: the flathead chub (*Platygobio gracilis*) (Antelope Creek, Upper Cheyenne River, and Little Powder River sub-watersheds), plains topminnow (*Fundulus sciadicus*) (Upper Cheyenne River), goldeye (*Hiodon alosoides*) (Little Powder River), lake chub (*Couesius plumbeus*) (Little Powder River), mountain sucker (*Catostomus platyrhynchus*) (Little Powder River), silvery minnow (*Hybognathus argyritis*) (Little Powder River), and plains minnow (Upper Cheyenne River, Upper Belle Fourche River, and Little Powder River). Potential impacts to special status fish species as a result of development activities would be similar to effects discussed above for fisheries. Surface disturbance in three sub-watersheds (Upper Cheyenne River, Upper Belle

Fourche River, Little Powder River) could alter habitat or affect water quality conditions for special status fish species. Erosion control measures, as required by existing (2003) and future permits, and NPDES permit requirements would be implemented for each project. These efforts would help decrease disturbance-related sediment input into stream segments that may contain one or more of the special status fish species. Therefore, it is anticipated that impacts to special status fish species would be low.

4.2.10 Land Use and Recreation

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts to land use and recreation as a result of projected development activities in the PRB Coal Review Task 3 study area (figure 4-4). The baseline year (2003) area of disturbance and reclamation related to surface coal mining and the projected cumulative areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in tables 4-2 and 4-3. Table 4-10 shows the total area of disturbance and reclamation for the baseline year and the projected cumulative total areas of disturbance and reclamation for 2010, 2015, and 2020.

The PRB is a predominantly rural, wide open landscape. With little rainfall and limited alternative sources of water, the primary land use is grazing. Nevertheless, there is a range of other land uses. The major categories include agriculture, forested, mixed rangeland, urban, water, wetlands, coal mines, and barren land. The relative amounts of these lands in the PRB Coal Review Task 1 and Task 2 study area (figure 4-1) is tabulated in table 4-27.

Table 4-27. PRB Land Use by Surface Ownership.

	Surface Ownership				Total	
Use Category	**BLM**	**USFS**	**State**	**Private**	**Acres**	**Percent**
Agriculture	2,627	14,197	13,770	472,811	503,405	6.3
Barren	165	205	187	9,396	9,953	0.1
Forested	137,555	14,604	48,645	332,062	532,866	6.7
Mixed Rangeland	732,014	218,156	561,363	5,271,644	6,783,177	86.0
Urban	893	17	1,039	25,469	27,418	0.3
Water	35	73	334	4,773	5,215	<0.1
Wetlands	0	104	559	1,566	2,229	<0.1
Coal Mines	149	7,236	2,805	40,917	51,107	0.6
Total	**873,438**	**254,592**	**628,702**	**6,158,638**	**7,915,370**	**100.0**

Source: PRB Coal Review Task 1D Report (BLM 2005d)

A large part of the PRB consists of split estate lands (privately owned surface lands underlain by federally owned minerals). This results in conflicts between surface users, which are mainly ranching interests, and mineral developers.

There also may be conflicts with some dispersed rural residences, although specific locations cannot be identified until development is proposed.

Much of the study area is also used for dispersed recreational activities such as hunting. The study area includes surface lands that are federally, state, and

privately owned. With nearly 80 percent of the area privately owned, public lands provide important open space and recreation resources including both developed recreation facilities and areas to pursue dispersed recreation activities. The private sector contributes the elements of commercial recreation opportunities and tourism services such as motels and restaurants. Some private land owners also allow hunting with specific permission, sometimes for a fee.

4.2.10.1 Grazing and Agriculture

Potential impacts to grazing in the Task 3 study area as a result of development activities can be classified as short-term and long- term. Potential short-term impacts arise from:

- the temporary loss of forage as a result of vegetation removal/ disturbance;
- temporary loss of AUMs;
- temporary loss of water-related range improvements, such as improved springs, water pipelines, and stock ponds;
- temporary loss of other range improvements, such as fences and cattle guards; and
- restricted movement of livestock within an allotment due to the development and operation of projects like surface coal mines, which would cease after successful reclamation had been achieved and replacement of water-related and other range improvements had been completed.

The discharge of produced water could increase the availability of water to livestock, which may offset the temporary loss of water-related range improvements. Potential long-term impacts consist of permanent loss of forage and forage productivity in areas, such as power plants, that would not be reclaimed in the near term. Indirect impacts may include dispersal of noxious and invasive weed species within and beyond the surface disturbance boundaries, which decreases the amount of desirable forage available for livestock grazing in the long term.

Development activities could result in short- and long-term impacts to agricultural land, depending on their spatial relationship. Short-term impacts would include the loss of crop production during development and operational phases of the projects. Long-term impacts would result from the permanent loss of agricultural land due the development of permanent facilities such as power plants and railroads.

Table 4-28 contains an estimate of the number of AUMs unavailable on lands disturbed and not yet reclaimed through 2020 for the high and low levels of predicted development activity, along with the acreage of cropland estimated to be affected.

Table 4-28. AUMs and Acres of Cropland Estimated Unavailable on Lands Disturbed and Not Yet Reclaimed as a Result of Development Activities.

Category	2003/ Baseline	2010/ Lower	2010/ Upper	2015/ Lower	2015/ Upper	2020/ Lower	2020/ Upper
Unavailable AUMs[1]	18,150	22,467	22,792	23,245	23,761	22,514	23,333
Unavailable Crop Land (acres)	48	59	60	134	139	206	289

[1] Based on an average stocking rate of six acres per AUM.
Source: PRB Coal Review Task 3D Report (BLM 2005f)

4.2.10.2 Urban Use

It is expected that there would be additional expansion of urban residential and commercial development as a result of the projected 48 percent growth in population (between 2003 and 2020) in Campbell County. Section 4.2.12 and the Task 3C Report of the PRB Coal Review (BLM 2005e) contain additional information on employment and population issues in the study area. A majority of the new urban development would be expected to occur adjacent to existing communities, primarily Gillette, which accounts for approximately 60 percent of the Campbell County population and, to a lesser extent, Wright and other small communities. Most of this development would occur on land that is currently in use for grazing or agriculture.

4.2.10.3 Recreation

Accessible public lands provide diverse opportunities for recreation, including hunting, fishing, ORV use, sightseeing, and wildlife observation. The National System of Public Lands generally provides dispersed recreational uses in the study area. Some developed recreational facilities occur in special management areas, including recreation areas. While opportunities are available on public lands throughout the PRB, the majority of dispersed recreational uses occur in the western part of the PRB Coal Review Task 1 and Task 2 study area, including the South Big Horn Mountains area and along the Powder River. Public lands elsewhere consist mainly of isolated tracts of land that are too small to provide a quality recreational experience. Larger parcels of public lands occur in the southwest part of Johnson County and along the Powder River (administered by BLM) and in the Thunder Basin National Grassland (administered by the USFS). Public lands are accessible via public roads or across private land with the landowner's permission.

Hunting is a major recreation use of state and federal lands in the study area. Various big game and upland game bird species are hunted in the region. Fishing is a popular year-round activity for residents of the study area.

Mule deer and pronghorn hunting are by far the most popular hunting activities in the Task 1 study area, accounting for 35,529 and 21,304 hunter days, respectively, in 2003 (Stratham 2005). The next highest were cottontail rabbit (2,348 hunter days) and elk (2,055 hunter days), followed by wild turkey (1,019), sharp-tailed grouse (508), and sage-grouse (38). Consistent trends in hunter activity over the past decade are not discernible from the WGFD data considered in the PRB Coal Review. All of the most prominent species hunted in the study area have had high years and low years. Pronghorn hunting, for example, was greatest from 1993 to 1996, while elk hunting was at its peak in 2001 and 2002. Mule deer hunting has been the most consistent, ranging from a low of 28,311 hunter days in 1996 to a high of 37,307 hunter days in 2002.

ORV use in the Task 1 study area is available on most BLM-managed lands. Most of the public land in Johnson, Sheridan, and Campbell Counties has been inventoried and designated as open, limited, or closed to ORV use. For the baseline year, approximately 20,386 acres were open to unlimited vehicle travel on and off roads. There were 4,680 acres in the area that were closed to all ORV use and approximately 867,534 acres were available for limited use. Limited use typically means ORVs are restricted to existing roads and vehicle routes.

Recreational use of public lands in the Task 1 study area has increased substantially over the past two decades, and is expected to continue to increase by about 5 percent every 5 years for most recreational activities (BLM 2003). Total visitor use by residents and nonresident visitors in Campbell and Converse Counties in 1980 was projected at 1,276,000 visitor days (BLM 1979). The total visitor days of 1,881,763 estimated for 1990 was approximately 47 percent higher than the 1980 visitor days (BLM 2001b). Fewer than 3 percent of visitor days were estimated to occur on public lands.

Few, if any, of the developed recreation sites in the PRB Coal Review Task 3 study area would be affected by development related disturbance. As most of the projected disturbance area would occur on privately owned surface land, the extent of effects on dispersed recreation activities largely would depend on whether the disturbance areas had been open to public or private lease hunting. It is projected that cumulative development activities, especially the dispersed development of CBNG and, to a lesser extent, conventional oil and gas, would tend to exacerbate the trend toward a reduction in private land available for public hunting, which has been observed by WGFD in recent years (Shorma 2005). A reduction in available private land for dispersed recreation would contrast with the anticipated increase in demand for recreational opportunities and would tend to push more recreationists toward public lands where the BLM has projected a 5 percent increase in use every 5 years (BLM 2001a). After coal- and oil and gas-related development activities have been completed and the

disturbed areas have been reclaimed, many of the adverse effects on dispersed recreation activities would be reduced.

It is expected that the development activities also would tend to expand and exacerbate the qualitative degradation of the dispersed recreation experience, in general, and of the hunting experience, in particular, as reported by the WGFD (Jahnke 2005). As noted in the Task 1D Report of the PRB Coal Review (BLM 2005d), reductions in land available for hunting also make herd management more difficult for the WGFD and reduce its hunting-derived revenues (Shorma 2005).

No direct effects on wilderness or roadless areas would be expected from the projected development activities. There are no designated wilderness areas in the study area, and mineral development would not be permitted in the Fortification Creek Wilderness Study Area until and unless Congress acts to remove it from Wilderness consideration.

There would be no effects on Wild and Scenic Rivers as the only river segment identified as both "eligible" and "suitable" in the Task 1D Report of the PRB Coal Review is not in the PRB Coal Review Task 3 study area.

4.2.11 Cultural Resources and Native American Concerns

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts to cultural resources as a result of projected development activities in the PRB Coal Review Task 3 study area. The baseline year (2003) area of disturbance and reclamation related to surface coal mining and the projected cumulative areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in tables 4-2 and 4-3. Table 4-10 shows the total area of disturbance and reclamation for the baseline year and the projected cumulative total areas of disturbance and reclamation for 2010, 2015, and 2020.

Cultural sites occur throughout the study area. Surface disturbing activities can result in the loss or destruction of these sites. Table 4-29 contains an estimate of the amount of projected disturbance through 2020 for the projected lower and upper levels of coal development activity, along with the number of cultural sites estimated to be affected. The sites fall into two categories; prehistoric sites and historic sites, as described below. Also below are description of Native American traditional cultural places and a summary of the program to protect sites in any of these categories.

4.2.11.1 Prehistoric Sites

All recognized prehistoric cultural periods, from Clovis through Protohistoric (about 11,500 to 200 years ago), are represented in the PRB Coal Review study area (see section 3.12 for additional discussion about the prehistoric cultural periods.) The earliest prehistoric cultural periods, Paleoindian through Early Plains Archaic, are represented by only a small number of sites. Archaic and

Table 4-29. Square Miles of Projected Cumulative Disturbance and Number of Potentially Affected Cultural Resource Sites in the PRB Coal Review Task 3 Study Area – Lower and Upper Coal Production Scenarios.

		Lower Coal Production Scenario						Upper Coal Production Scenario					
		Year 2010		Year 2015		Year 2020		Year 2010		Year 2015		Year 2020	
Sub-watershed	Average Number of Sites per Square Mile[1]	Square Miles[2]	Sites[3]	Square Miles[2]	Sites[3]	Square Miles[2]	Sites[3]	Square Miles[2]	Sites[3]	Square Miles[2]	Sites[3]	Square Miles[2]	Sites[3]
Antelope Creek	4.7	74	346	97	484	122	608	75	376	99	496	126	629
Dry Fork Cheyenne River	8.9	8.3	74	12	109	17	151	8.3	74	12	109	17	151
Little Powder River	4.6	90	415	108	495	123	567	91	419	109	502	125	577
Upper Belle Fourche River	4.3	164	704	186	801	209	899	166	713	192	824	219	940
Upper Cheyenne River	5.2	60	314	72	375	83	433	62	321	74	387	85	445
Upper Powder River	5.0	135	674	190	953	232	1,159	135	674	191	953	232	1,159
Total		**531**	**2,527**	**665**	**3,217**	**786**	**3,817**	**537**	**2,577**	**677**	**3,271**	**804**	**3,901**

1 Average number of sites per square mile based on previous surveys in the study area.
2 Calculated, based on database disturbance acreages prepared for the Task 2 Report for the PRB Coal Review, Past and Present and Reasonably Foreseeable Development (Appendices A and D) (BLM 2005a).
3 The number of sites was calculated by multiplying the average density of known cultural sites per square mile (based on previous surveys) by the number of square miles of projected cumulative disturbance.

Source: Task 3D Report for the PRB Coal Review Cumulative Environmental Effects (BLM 2005f)

later prehistoric period sites (Archaic to Protohistoric) are represented in increasing numbers as a result of higher populations through time and better preservation of more recent sites. Important prehistoric site types in the region include artifact scatters, campsites, stone circles, faunal kill and processing sites, rock alignments and cairns, and stone material procurement areas.

Artifact scatters dominate prehistoric sites in the study area. When there is adequate information to evaluate these types of sites, most are not eligible to the NRHP. However, complex sites and sites with buried and dateable material can yield important information and are often field evaluated as eligible. The proportion of unevaluated sites is lower in the subwatersheds in which more studies and more follow-up studies have been conducted, such as Antelope Creek, Upper Cheyenne River, and Upper Belle Fourche River. Some portions of some of the subwatersheds which have more varied habitats or conditions more conducive to preservation are very rich in significant prehistoric sites. Within the PRB Coal Review Task 3 study area, these areas include the lower Antelope Creek drainage and eastern portions of the Upper Belle Fourche River. While prehistoric sites do exist in the general South Gillette analysis area, it does not appear to be particularly plentiful in significant prehistoric sites. More detailed information on the known cultural sites that are present in the PRB based on the existing surveys is included in the Task 1D Report for the PRB Coal Review (BLM 2005d).

4.2.11.2 Historic Sites

In the PRB region, sites are documented within the broad contexts of Rural Settlement, Urban Settlement, Mining, Transportation, Military, Exploration, and Communication. Each of these site categories and the types of sites they include are detailed in the Task 1D Report for the PRB Coal Review (BLM 2005d). Evaluation of the importance of historic sites, districts, and landscapes must consider aspects of both theme and period in assessing the historic character and contributing attributes of the resources.

4.2.11.3 Native American Traditional Cultural Places

General ethnographies of the tribes that may have had traditional ties to this region do not provide information on specific resources in the study area that are likely to be traditional cultural concerns because these resources are considered confidential by the tribes. Within this region, there are prominent and identifiable places such as the Medicine Wheel to the west in the Big Horn Mountains and Devils Tower to the east in the Black Hills area. These known sites offer some indication of the types of places valued by the Plains horse cultures in the historic period. Any identification of sacred or traditional localities must be verified in consultation with authorized tribal representatives.

4.2.11.4 Site Protection

At the time an individual project is permitted, the development activities considered in this study would be subject to the following regulations relative to cultural resources. Section 106 of the National Historic Preservation Act of 1966 as amended, its implementing regulations (including but not limited to 36 CFR 800, 36 CFR 61, and Executive Order 11593), and NEPA and its implementing regulations, including 40 CFR 1500 - 1508, provide the legal environment for documentation, evaluation, and protection of historic properties (i.e., cultural resources eligible for inclusion on the NRHP) that may be affected by development activities. In cases of split estate (where surface ownership and mineral ownership differ), surface resources, such as cultural sites, belong to the surface owner. The surface owner must be consulted about investigation, mitigation, or monitoring.

4.2.12 Transportation and Utilities

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts to transportation and utilities systems as a result of projected development activities in the PRB Coal Review Task 3 study area. The baseline year (2003) area of disturbance and reclamation related to surface coal mining and the projected cumulative areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in tables 4-2 and 4-3. The total area of disturbance and reclamation for the baseline year and the projected cumulative total areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in table 4-10.

Generally, transportation systems in the study area would not be directly affected by the disturbance associated with projected development. Site-specific instances of disturbance may require that segments of highways, pipelines, transmission lines, or railroads be moved to accommodate expansion of certain coal mines. In such cases, the agencies authorized to regulate such actions would have to approve any proposal to move any segments of any transportation systems and construction of alternative routing would be required prior to closing existing links so that any disruptive effects on transportation systems would be minimized.

The coal mines in the North Gillette subregion currently ship most of their coal via the east-west BNSF rail line through Gillette. That subregion produced 55 mmtpy in the baseline year (2003), which was just 22 percent of the estimated 250 mmtpy capacity of the BNSF rail line (BLM 2005f). The coal mines in the South Gillette and Wright subregions produced approximately 308 mmtpy in 2003, which was 88 percent of the estimated 350 mmtpy capacity of the joint BNSF & UP line serving those areas in the baseline year.

Potential effects of development activities on transportation and utilities may be either short- or long-term in nature, varying with the type of development. A power plant or an urban community development would be considered long-

term, and the demand for transmission line capacity would be virtually permanent, lasting for the economic life of the activity. The effects of coal production and the related demand for rail capacity would vary with market changes. In recent years, coal production has been increasing and the PRB Coal Review projects that the trend would continue, as shown in tables 4-2 and 4-3. Similarly, the demand for pipeline capacity would vary with market conditions as well as with the rate of depletion of the oil or gas resource.

Potential direct effects of projected development on roads and highways would include increased vehicular traffic and risk of traffic accidents on existing roadways in the PRB Coal Review Task 3 study area from daily travel by workers and their families. Indirect effects would include increased wear and tear on existing roads, additional air emissions from vehicles, additional fugitive dust from roads, noise, increased potential access to remote areas, and an increased risk of vehicle collisions with livestock and wildlife. Direct effects on railroads, pipelines, and transmission lines primarily would include increased demand for capacity to move coal, oil and gas, and electricity from production locations in the study area to markets outside the area. Indirect effects would include potential impacts of the accumulation of coal dust and fines blowing or sifting from moving, loaded rail cars. The PRB Coal Review Task 3D Report does not discuss the cumulative effects of coal dust resulting from the transport of coal along rail lines.

The socioeconomic analysis conducted as a part of Task 3C of the PRB Coal Review projects a population increase of approximately 48 percent between 2003 and 2020 in Campbell County under the upper coal production scenario (BLM 2005e). Campbell County accounts for most of the population in the PRB Coal Review Task 3 study area. Based on traffic studies conducted independently of the PRB Coal Review, vehicle miles traveled tend to increase at or above the rate of population growth. Consequently, highway traffic would be expected to increase by at least 48 percent by 2020. Approximately 60 percent of the population growth would occur in or near Gillette, which would indicate that the same proportion of traffic would originate in the Gillette area. The remainder of the traffic growth would be dispersed throughout the study area. Under this scenario, the greatest impact on traffic would occur in the Gillette area, where existing traffic volume to capacity ratios are highest. The increased traffic would be expected to cause delays in the Gillette area and might require widening of some streets and roads or other measures to increase traffic capacity. It is anticipated that there would be an increase in the risk of traffic accidents approximately proportional to the increase in traffic. Highway capacity on major routes away from Gillette would be expected to be sufficient to accommodate the growth without substantial constraints.

Existing rail lines, together with proposed upgrades on the joint BNSF & UP line, would be expected to accommodate the projected coal transportation traffic through 2015 (table 4-30). The PRB Coal Review Task 2 Report (BLM 2005a) projects that the proposed DM&E line would be built and operational by 2015 (pending completion of additional environmental analysis), which would add 100

Table 4-30. PRB Rail Lines Coal Hauling Capacity and Projected Use.

Rail Line	2010 Capacity	2010 Projected Rail Use Increase[1]		2015 Capacity	2015 Projected Rail Use Increase[1]		2020 Capacity	2020 Projected Rail Use Increase[1]	
	mmtpy	mmtpy	%	mmtpy	mmtpy	%	mmtpy	mmtpy	%
North BNSF	250	62-78	25-31	250	74-104	30-42	250	78-121	31-48
South BNSF & UP	400	349-401	87-100	500	393-439[2]	79-88[2]	500	417-455[2]	83-91[2]
DM&E	0	0	0	- [2]	- [3]	- [3]	- [2]	- [3]	- [3]

[1] The range of increase in use shown for each year reflects the increases that are projected for the Lower and Upper Coal Production Scenarios, respectively.
[2] The DM&E is assumed to be built and operational by 2015, adding 100 mmtpy of capacity for the mines served by the BNSF & UP South line.
[3] The BNSF & UP South figures represent the projected combined traffic and percent capacity on the BNSF & UP South line and the projected DM&E line.
Source: PRB Coal Review Task 3D Report (BLM 2005f)

mmtpy in additional shipping capacity for the South Gillette and Wright subregions. A collaborative effort between the National Coal Transportation Association, the mines, and the BNSF and UP Railroads is resulting in measures to reduce coal dust emissions from loaded, moving rail cars.

The Task 2 Report for the PRB Coal Review projected that basin-wide production of CBNG could potentially double by 2020, which would suggest that additional pipelines could be built. One potential additional pipeline (Bison Project) was identified for completion by November 2010. The filing for this project was made with Federal Energy Regulatory Commission (FERC) on June 2, 2008. Other potential projects are discussed in section 4.1.2.3.1 was (Bison Pipeline 2008).

An estimated 1,700 MW of new power production capacity is anticipated in the cumulative effects area by 2020. This level of production would require construction of additional transmission line capacity. It is assumed that new transmission lines would be constructed to connect new power plants to the grid.

4.2.13 Socioeconomics

The cumulative socioeconomic impact analysis focuses on Campbell County, but also considers Converse, Crook, Johnson, Sheridan, and Weston Counties as directly affected and Niobrara and Natrona Counties as indirectly affected. Recent and projected socioeconomic conditions are described in more detail in the Task 1C and 3C reports for the PRB Coal Review (BLM 2005c and 2005e).

REMI Policy Insight (REMI), a professionally recognized regional economic model, was used to develop the cumulative employment and population projections presented below. The version of the REMI model for the Coal Review was comprised of two economic regions: one being Campbell County alone, the second composed of those Wyoming counties bordering Campbell County and

linked to its economy by established industrial and consumer trade linkages and by work force commuting patterns. Results for the second region were analyzed to focus on the five counties, Converse, Crook, Johnson, Sheridan, and Weston, that are the most directly linked. Collectively, these five counties are referred to in the PRB Coal Review Task 3C Report (BLM 2005e) as the surrounding counties. Additional analysis was undertaken to translate the population and employment forecasts for each of the surrounding counties into housing needs and to project future school enrollment.

During the 1970s and early 1980s, the PRB emerged as a major coal producing region. Federal coal leasing has been a high profile activity because over 90 percent of the coal resources in the PRB are federally owned. The surface coal mines that developed during the 1970s and early 1980s are now mature operations, providing a stable economic and social foundation for the region. While energy development has produced periodic surges in population, followed occasionally by population declines in some communities, the growth in domestic energy consumption, coupled with the PRB's vast energy resource base, has resulted in a 50-year growth trend in the region without the severe economic dislocations that have characterized other western U.S. resource booms.

This period of extended energy development has been accompanied by substantial economic changes and benefits, including economic growth, employment opportunity, tax revenue growth, and infrastructure development for local governments, both locally and across Wyoming, funded by tax revenues generated by production of coal and other energy resources. At the same time, periods of rapid growth have stressed communities and their social structures, housing resources, and public infrastructure and service systems.

The emergence of the coal and other energy resource development industries in the PRB has had long-term cumulative affects on regional social and economic conditions. In general, Campbell County and the entire PRB region have developed an enhanced capacity to respond to and accommodate growth. The regional coal industry also provides a measure of insulation from dramatic economic and social dislocations. Key cumulative social and economic conditions identified in the PRB Coal Review are described below.

4.2.13.1 Employment and the Economic Base

Energy resource development since 1970 has resulted in substantial economic expansion across the PRB. Total employment expanded by 163 percent as 40,674 net new jobs were added between 1970 and 2004. The most rapid expansion occurred between 1975 and 1980. After modest growth and slight decline in the 1980s and early 1990s, employment growth resumed in the late 1990s, led by increases in coal mine employment, including subcontractors, and CBNG development. Across the six-county area, total employment was 65,597 in 2004. Nearly half of the net job gain occurred in Campbell County, where total employment increased from 6,026 jobs in 1970 to 25,921 jobs in

2004. Strong gains also were posted in Sheridan County (9,821 jobs) and Converse County (4,421 jobs).

The economic stimuli associated with the gains in mining and CBNG employment and the long-term population growth triggered secondary job gains in construction, trade, services, and government. In 2004, business and consumer services accounted for 51 percent of all jobs in the region, while mining and government accounted for 14 percent and 16 percent of all jobs, respectively. Farm employment in the region, as a share of total employment, declined from 14 percent in 1970 to 5.0 percent in 2004. However, that shift is primarily due to growth in non-farm employment rather than declines in farming, as total farm employment in the PRB recorded a net decline of only 375 jobs, from 3,571 to 3,196 (U.S. Bureau of Economic Analysis 2006).

The largest impetus to future growth over the PRB Coal Review study period (2003 to 2020) is expected to occur by 2010. Under the lower production scenario, employment in 2010 related to coal mining, oil and gas production, and oil field services is projected to increase by one-third, or more than 2,300 jobs, as compared to 2003 levels. Many of the jobs gained would be the result of increased oil and gas development. While the number of coal mining jobs would increase, the projected coal mine-related productivity gains would limit increases in the number of mine employees required for operations.

Beyond 2010, total mining industry employment would decline as major infrastructure development (e.g., additional CBNG compression capacity) is completed and the pace of conventional oil and gas drilling decreases. Increases in CBNG production and coal mining employment would occur thereafter, such that total mining employment would approach pre-2010 levels by the end of the forecast period (2020). Under the development scenarios, construction of three new power plants, having a combined capacity of 1,000 MW and a peak work force of approximately 1,550 in 2007-2008, is assumed to occur concurrently with the increases in mining employment. Under the upper production scenario, a second temporary construction work force impact would occur between 2016 and 2020 in conjunction with the construction of an additional 700-MW power plant.

The net effects of these activities, including secondary effects on suppliers, merchants, service firms, state agencies and local government in the region, would be the creation of more than 8,700 new jobs in the region between 2003 and 2010. Of those, more than 5,600 jobs (a 22 percent increase over 2003) would be based in Campbell County. The pace of economic expansion, at least in terms of jobs, would moderate after 2010. Total employment growth of 2,017 additional jobs is projected in Campbell County between 2010 and 2020, with 1,741 additional jobs projected in the surrounding counties.

However, to achieve the projected levels of energy and mineral development activity through 2010 assumes that industry has access to the necessary equipment, materials, labor, and other vital inputs. Current oil and gas

exploration and development across the Rocky Mountain region has absorbed the available inventory of drilling rigs and crews. A lack of access to resources could delay or limit the job gains below the levels projected, even though prospects for such growth remain. Furthermore, competition for equipment, combined with tight labor markets, could negate the productivity gains that underlie the projections, such that the employment and associated impacts do materialize, but are associated with lower levels of activity (e.g., a lengthier construction period for a power plant or fewer new wells drilled each year).

Employment effects associated with the upper coal production scenario, assuming productivity gains in coal mining equivalent to those in the lower coal production scenario, would result in total employment gains of 11,563 jobs by 2010 in the six-county study area, with an additional 3,667 jobs by 2020[2]. As compared to the employment projections under the lower coal production scenario, those gains include 2,821 additional jobs in 2010 and 3,214 additional jobs in 2020. Most of the incremental gains would be in Campbell County, further stressing labor markets, housing, and other community resources. Such pressures could delay or affect the development plans of individual firms and operators, such that the projected employment levels would not be realized in the time frames shown. Nonetheless, substantial growth in employment is expected to occur, and even if the projected total employment levels are not realized, substantial social and economic impacts still would be anticipated.

The economic stimuli associated with the projected development also would stimulate increases in employment in other nearby counties beyond the five surrounding counties identified above. However, the potential effects in these areas are not addressed in the PRB Coal Review Task 3C Report because most of the effects would comprise indirect or induced growth that would be limited in scale relative to the size of the respective economies. Furthermore, the economic outlook for those areas is influenced by factors that are beyond the scope of this study, such as the role of the oil and gas support services industry based in Natrona County in supporting energy development in the south-central and southwestern portions of Wyoming.

4.2.13.2 Labor Market Conditions

Labor market conditions in the PRB reflect a generally healthy economy, with average annual county unemployment rates between 2.1 percent (Campbell) and 3.5 percent (Weston) in 2006. Statewide and national unemployment rates for

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2 The number of jobs in the coal mining industry under the upper production scenario was estimated assuming future productivity gains comparable to those used for the lower production scenario. This approach differs from that described for the upper production scenario in the Task 2 report of the coal study, whereby a 16 percent higher production would be achieved with a 2.5 percent increase in workforce. Although that assumption reflects a continuation of historic productivity gains, it may underestimate population and employment growth and related socioeconomic effects if the production levels are achieved but productivity lags. Using the productivity gains from the lower production scenario provides a more conservative perspective on potential long-term population growth for purposes of the cumulative analysis.

the period were 3.2 percent and 4.6 percent, respectively (U.S. Bureau of Labor Statistics 2007).

Over time, local unemployment levels and rates have reflected the influences of the large, relatively stable employment baseline associated with the region's coal mining industry and the more transitory and variable influences of natural gas development. Prior to the onset of CBNG development in 1989, unemployment in Campbell County fluctuated between 4.8 and 5.3 percent, slightly above the corresponding statewide averages. Labor demand associated with CBNG development contributed to a decline in unemployment to below 3.0 percent in the 2001. As the pace of CBNG development stabilized, labor demand eased and unemployment rates climbed to 3.7 percent in 2003, before again falling to current record lows.

The employment effects identified above indicate substantial pressures on local labor markets. Strong demand for labor would maintain low unemployment, creating upward pressure on wages and salaries. Those influences would stimulate substantial economic migration into Campbell County, causing impacts to population, housing demand, and other economic and social conditions. Similar influences would occur in surrounding counties, although the implications are less severe because the scale of effects would be smaller and would be distributed over multiple communities and service providers.

4.2.13.3 Personal Income

A benefit associated with energy resource development, whether it is mineral mining or oil and gas development, is local wages and salaries that are among the highest in the state. Personal income registered strong gains across the region, but especially in Campbell County, during the late 1970s and early 1980s. In 1981, per capita personal income in Campbell County was $17,520, compared to the national average of $11,280 and the statewide average of $12,879. Personal income growth was tempered by several years of economic stagnation during the late 1980s. Renewed economic vitality since then resulted in per capita personal income in Campbell County reaching $33,388 in 2004. Those gains notwithstanding, per capita income among Campbell County's residents was below statewide and national norms, as well as that for Sheridan ($35,716) County. When measured on a median household or family income basis in the 2000 census, Campbell County led statewide, national, and other counties in the PRB by considerable margins. That pattern has been maintained due to the strong economic growth in the region; in 2006 the median household income in Campbell County was $60,800 compared to a statewide median of $43,785 and national median of $44,374. Median household incomes for the other five PRB counties ranged from $40,195 to $46,883 (U.S. Census Bureau 2006a).

In terms of total personal income, Campbell County led the six-county region with $1.22 billion in 2004. Sheridan County residents recorded aggregate personal income of $972 million in 2004. Total personal income in the other

counties was substantially lower, ranging from $193 million in Crook County to $389 million in Converse County.

Personal incomes in the region would increase over the time period 2007-2020, both in aggregate and on a per capita basis, in conjunction with the economic outlooks foreshadowed by the projected development scenarios. In 2004, total personal income in the six-county area was $3.24 billion. Under the lower production scenario, total personal income would more than double to $7.57 billion in 2020 (in nominal dollars). The upper production scenario would generate an additional $266 million per year in Campbell County and an additional $35 to $40 million per year in the surrounding counties by 2020. Annual per capita incomes are projected to increase by approximately 27 percent (in real terms) across the region between 2003 and 2020. Households with one or more workers employed directly in the energy industry, associated service firms, and the construction industry likely would realize larger shares of the gains (BLM 2005e).

4.2.13.4 Population and Demographics

Population change over time is perhaps the single best indicator of cumulative social and economic change in the PRB. Campbell County was not among the original 13 counties when Wyoming was admitted to statehood, but was carved from Weston and Crook Counties in 1911. Campbell County's 1920 population of 5,233 ranked it seventeenth among Wyoming's counties. Forty years later and prior to the onset of coal development in the region, Campbell County ranked eighteenth among Wyoming's counties in terms of population, with a 5,861 residents. Neighboring Converse, Sheridan, and Weston Counties all had larger populations.

By 1980, Campbell County's population had increased by more than 300 percent, to 24,367, seventh among Wyoming's counties. Energy development contributed to population growth in Sheridan, Converse, Johnson, and Crook Counties during that period. Weston County recorded a population decline during the period; however, the combined population of the PRB climbed from 49,311 in 1960 to 82,598 in 1980.

Annual coal production in the PRB has increased by nearly 560 percent since 1980, accompanied by expanded mine service and rail transportation capacity, stimulating further growth. The impetus for growth in local employment was tempered by substantial productivity increases in the mining industry, coupled with declining production of other energy resources. Consequently, the region's population gained a relatively modest 11 percent, 9,318 residents, between 1980 and 2000, reaching 91,916. Campbell County registered a net gain of 9,331 residents during that period, raising its total population to 33,698 in 2000, fourth highest in the state. Across the PRB, the loss of about 2,000 residents in Converse County was offset by modest gains in the other four counties (U.S. Census Bureau 2001).

More recently, the PRB has seen renewed population growth, primarily linked to CBNG development. Population estimates for 2006 indicate a total regional population of 100,504, a 9.3 percent increase over the 2000 census population. Gains were reported for all six counties, ranging from 118 persons in Weston County to 5,236 persons in Campbell County (table 4-31).

Table 4-31. Recent and Projected PRB Population.

Year	Campbell County	Converse County	Crook County	Johnson County	Sheridan County	Weston County	Six County PRB Total
				Census			
2000	33,698	12,104	5,895	7,108	26,606	6,642	92,053
2003	36,381	12,326	5,971	7,530	27,116	6,665	95,989
2006	38,934	12,866	6,255	8,014	27,673	6,762	100,504
				Lower Coal Production Scenario			
2010	45,925	13,103	6,542	8,389	28,459	7,108	109,526
2015	48,905	13,671	6,759	8,867	30,016	7,174	115,392
2020	50,995	14,193	6,989	9,326	31,467	7,208	120,178
				Upper Coal Production Scenario			
2010	47,662	13,160	6,570	8,424	28,579	7,137	111,532
2015	51,558	13,763	6,802	8,924	30,214	7,219	118,480
2020	54,943	14,313	7,045	9,403	31,733	7,266	124,703

Source: U.S. Census Bureau (2006b - historical data) and PRB Coal Review Task 3C Report (BLM 2005e)

The magnitude and timing of projected employment changes from 2003-2020 under either coal production scenario would trigger corresponding effects to population across the PRB, particularly in Campbell County (figure 4-6).

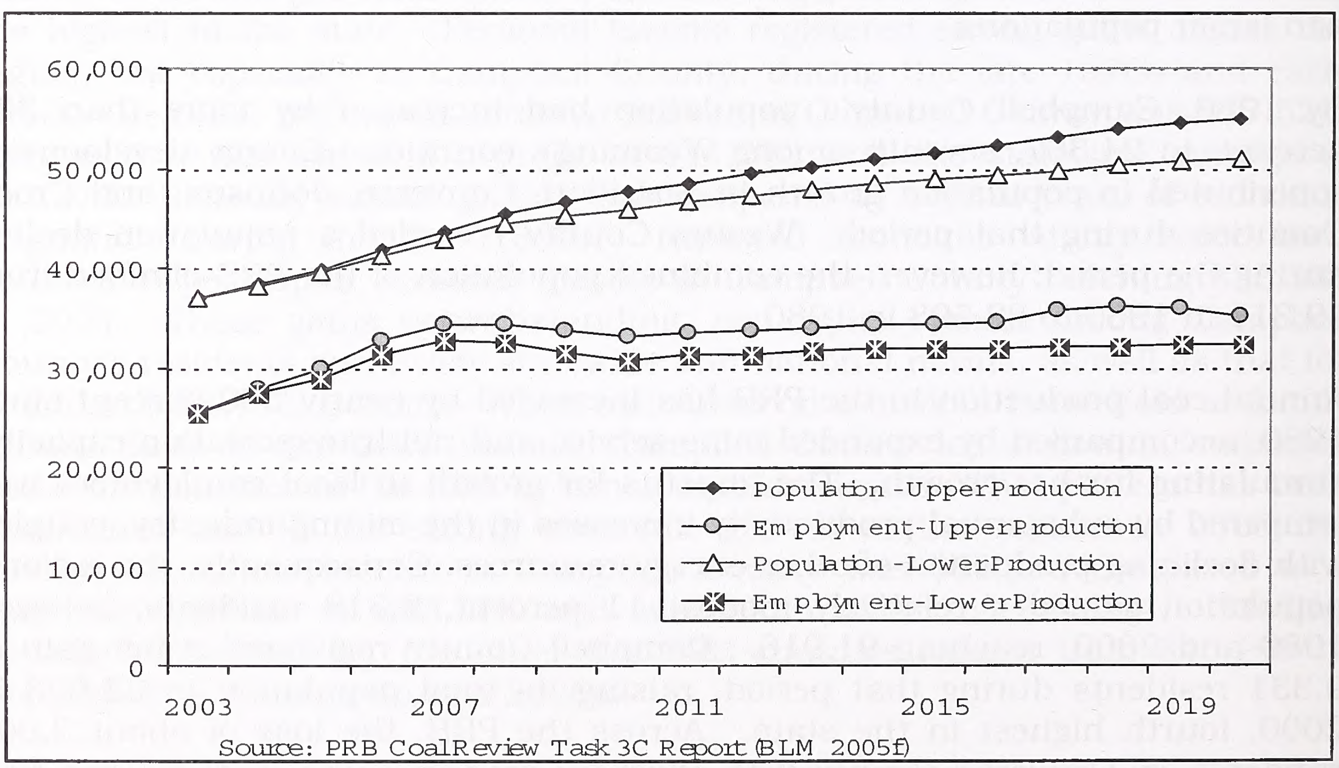


Figure 4-6. Projected Campbell County Population and Employment to 2020.

Under the lower coal production scenario, Campbell County's population is projected to increase by more than 14,550 residents between 2003 and 2020, nearly 9,500 of which are anticipated by 2010. Growth over the next 3 years will maintain pressures on housing and other community resources. The projected energy and mineral development in the lower coal production scenario would also result in substantial population growth elsewhere in the PRB, with Sheridan, Johnson, and Converse Counties all projected to gain substantial population. Population growth, like employment growth, would moderate after 2010. Projected population growth between 2003 and 2020 ranges from 0.5 percent compounded annual growth rate (CAGR) in Weston County to 2.0 percent CAGR in Campbell County. In absolute terms, the net change ranges from 537 additional residents in Weston County to a gain of 14,557 residents in Campbell County. The total population of the six-county study area is projected to climb to 120,178 in 2020, a 1.3 percent CAGR.

As with employment, changing development conditions could result in actual population growth varying from projected growth. If project schedules or levels of development vary from the projected levels, corresponding effects on population growth could result (e.g., lower growth). Population demographics could also change due to migration and commuting, with more immigrating construction workers being single-status, rather than accompanied by families. Another possibility is that the spatial distribution of population growth could shift as a result of housing or labor constraints, such that less growth would occur in Gillette and Campbell County, and more growth would occur elsewhere.

Projected population growth through 2020 under the upper coal production scenario is approximately 19 percent higher than under the lower coal production scenario (28,625 compared to 24,100, with the six-county population reaching 124,703 by 2020). Much of the incremental population growth would occur by 2010 in Campbell County, and in particular in and near Gillette.

Community population growth under the upper coal production scenario generally would mirror growth under the lower coal production scenario but with higher growth in Wright, Douglas, and Newcastle due to the effects of higher coal production, coal transportation, and power generation concentrated in the southern portion of Campbell County.

4.2.13.5 Housing

While the population grew by 55 percent in the 1970s, the housing stock in the study area grew by almost 78 percent. Housing growth was especially rapid during the 1970s in Campbell County, where population grew by 88 percent and the housing stock grew by 140 percent. The expansion in housing supply, combined with the slowdown in the rate of population growth, produced double-digit vacancy rates for rental housing in the late 1980s and early 1990s. After growth resumed in the mid-1990s, most county-level vacancy rates for ownership units were at or below the state levels in 2000. Vacancy rates for rental units declined even more sharply. Vacancy rates have fallen even more as

a result of recent growth, with current rates below 1.5 percent in five of the six-counties, and that in Johnson County at only 2.8 percent (table 4-32).

Table 4-32. Rental Housing Vacancy Rates, 2004 4Q and 2006 4Q.

Year	Campbell County	Converse County	Crook County	Johnson County	Sheridan County	Weston County	Wyoming
2004 4Q	2.8%	8.3%	10.4%	2.1%	4.5%	5.0%	4.8%
2006 4Q	0.4%	1.4%	1.0%	2.8%	0.5%	0.0%	2.4%

Source: Wyoming Housing Database Partnership (2007)

In 2000, the housing inventory in the six-county study area was 41,203 units (table 4-33). Total housing inventory had expanded to 43,363 units in 2005, a net addition of 2,160 since 2000. However, new construction hasn't kept pace with population growth, resulting in tighter market conditions in terms of availability, and higher prices.

Table 4-33. Total Housing Stock in 2000 and 2005.

Year	Campbell County	Converse County	Crook County	Johnson County	Sheridan County	Weston County	Six-county PRB Region
2000	13,288	5,669	2,935	3,503	12,577	3,231	41,203
2005	14,085	5,852	3,132	3,694	13,283	3,317	43,363
Change	797	183	197	191	706	86	2,160

Source: U.S. Census Bureau (2006b)

In 2005, the average sales price of homes in the study area varied from $80,303 in Weston County to $186,095 in Sheridan County. The average home price statewide in 2006 was $178,183 (Wyoming Housing Database Partnership 2007). In addition to Sheridan County, Campbell ($185,874) and Johnson ($180,209) Counties also had average home sale prices above the statewide average in 2006. The average sales price in Converse County was $149,096, 17 percent below the statewide average.

Monthly costs for rental housing in the PRB, measured in the fourth quarter of 2006, were highest in Campbell County (table 4-34).

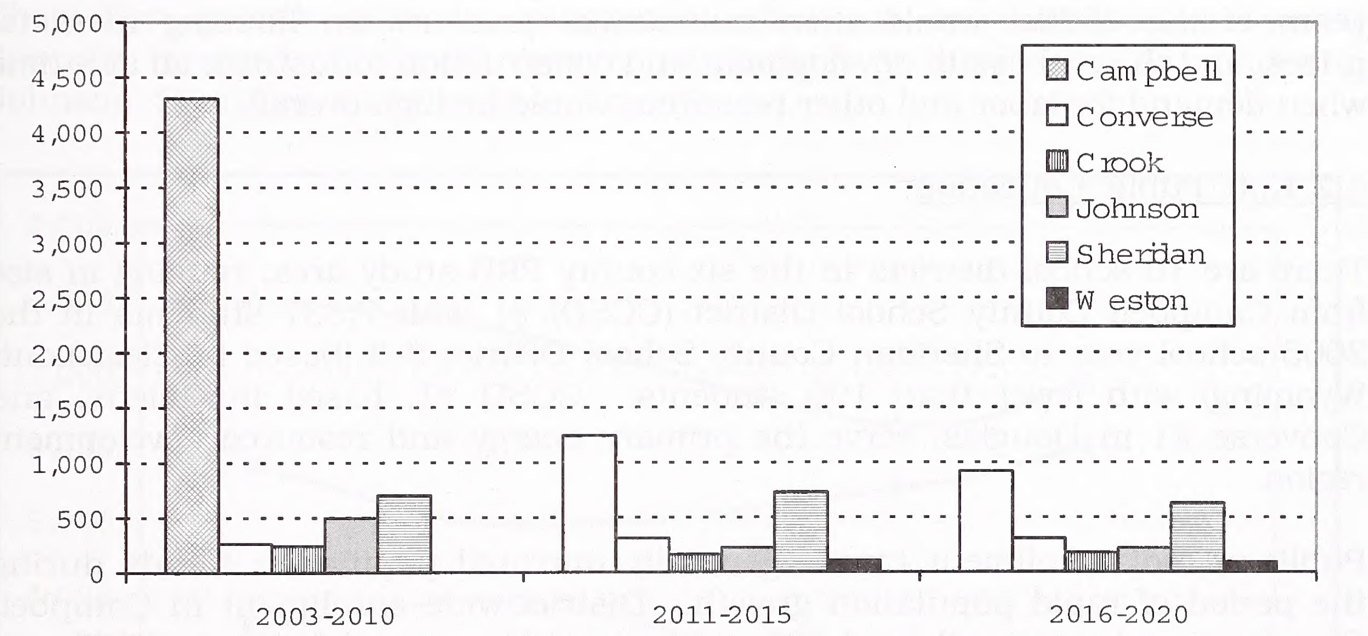
Table 4-34. Monthly Housing Rents in 2006[1] in the PRB Study Area and Percent Change from 2004.

County	Apartments		Mobile Home Lots		Houses		Mobile Homes on a Lot	
	Rent	Change	Rent	Change	Rent	Change	Rent	Change
Campbell	$697	25.8%	$283	22.0%	$975	23.0%	$758	20.5%
Converse	$515	31.4%	$152	1.3%	$545	2.8%	$452	22.5%
Crook	$391	17.4%	$125	5.9%	NA	NA	NA	NA
Johnson	$477	-5.4%	$170	16.4%	$700	15.3%	$518	5.5%
Sheridan	$571	14.0%	$285	4.4%	$857	27.9%	$650	26.7%
Weston	$459	47.1%	$119	17.8%	$567	36.3%	$505	27.5%
Wyoming	$567	14.1%	$225	15.4%	$782	13.0%	$561	15.2%

[1] Data are for the fourth quarter of 2006. Change is the percent change since fourth quarter of 2004.
NA = information not available due to insufficient sample size.
Source: Wyoming Department of Administration and Information (2006)

Temporary housing resources are available in the PRB in the form of hotel-motel rooms, private and public campgrounds, and vacant spaces in mobile home parks. In all, there are more than 70 lodging establishments with a total of more than 2,500 rooms. These temporary housing resources, supplemented by whatever apartments, townhouses, and mobile home spaces are available in Gillette, Wright and Douglas, have accommodated temporary housing needs associated with natural resource and energy projects in the past.

Both projected coal production scenarios indicate a strong demand for housing across the six-county study area through 2020. Net housing requirements under the lower coal production scenario are for approximately 9,110 units through 2020, a 21 percent increase above the 2006 existing inventory (figure 4-7). New housing requirements under the upper coal production scenario are estimated at 10,900 units, a 25 percent increase compared to the 2006 inventory and 1,790 units more than for the lower coal production scenario. Approximately 60 percent of the overall demand for new housing through 2010 would be in Campbell County.



Source: PRB Coal Review Task 3C Report (BLM 2005f)

Figure 4-7. Projected Housing Demand in the PRB Study Area Under the Lower Coal Production Scenario.

A substantial portion of the near-term housing demand in Campbell County would be associated with the assumed concurrent construction of three power plants. If that occurs, one or more project sponsors may be required by the Wyoming Industrial Siting Administration to pro-actively provide housing (e.g., a construction camp for single-status workers). Such actions could temper the needs for more housing; however, the remaining needs would nonetheless be substantial, straining public and private sector residential development capacity. Although smaller in scale than those in Campbell County, housing demands in the surrounding counties may also strain the capabilities of the residential construction sector to respond. Furthermore, residential contractors would be

competing for available labor, contributing to the population growth and housing demand, and fueling increases in construction costs and housing prices.

The relative scale of the housing needs can be evaluated in comparison to past growth in the study area. One benchmark for comparison is the rapid growth that occurred in the PRB in the 1970s. During that decade, the number of housing units in the six-county study area rose by approximately 14,900 units, approximately 1,500 units per year on average compared to the 850 to 975 new units per year projected under the upper and lower coal production scenarios through 2010. The rapid pace of development in the 1970s coincided with a period of economic expansion and strained the region's construction trade and building supply industries. Although the underlying economies of the region are now larger, the projected needs would tax the ability of communities to respond. Signs of strain are apparent in Gillette and could surface elsewhere as greater housing needs arise in the remaining counties of the six-county study area under the low coal production scenario.

Projected housing demands under either coal production scenario, although lower than what Campbell County and the region experienced in the "boom" years of the 1970s, would exert substantial pressure on housing markets, prices, and the real estate development and construction industries, all at a time when demand for labor and other resources would be high overall.

4.2.13.6 Public Education

There are 10 school districts in the six-county PRB study area, ranging in size from Campbell County School District (CCSD) #1 with 7,337 students in the 2005 school year to Sheridan County School District # 3 (based in Clearmont, Wyoming) with fewer than 100 students. CCSD #1, based in Gillette, and Converse #1 in Douglas, serve the primary energy and resource development region.

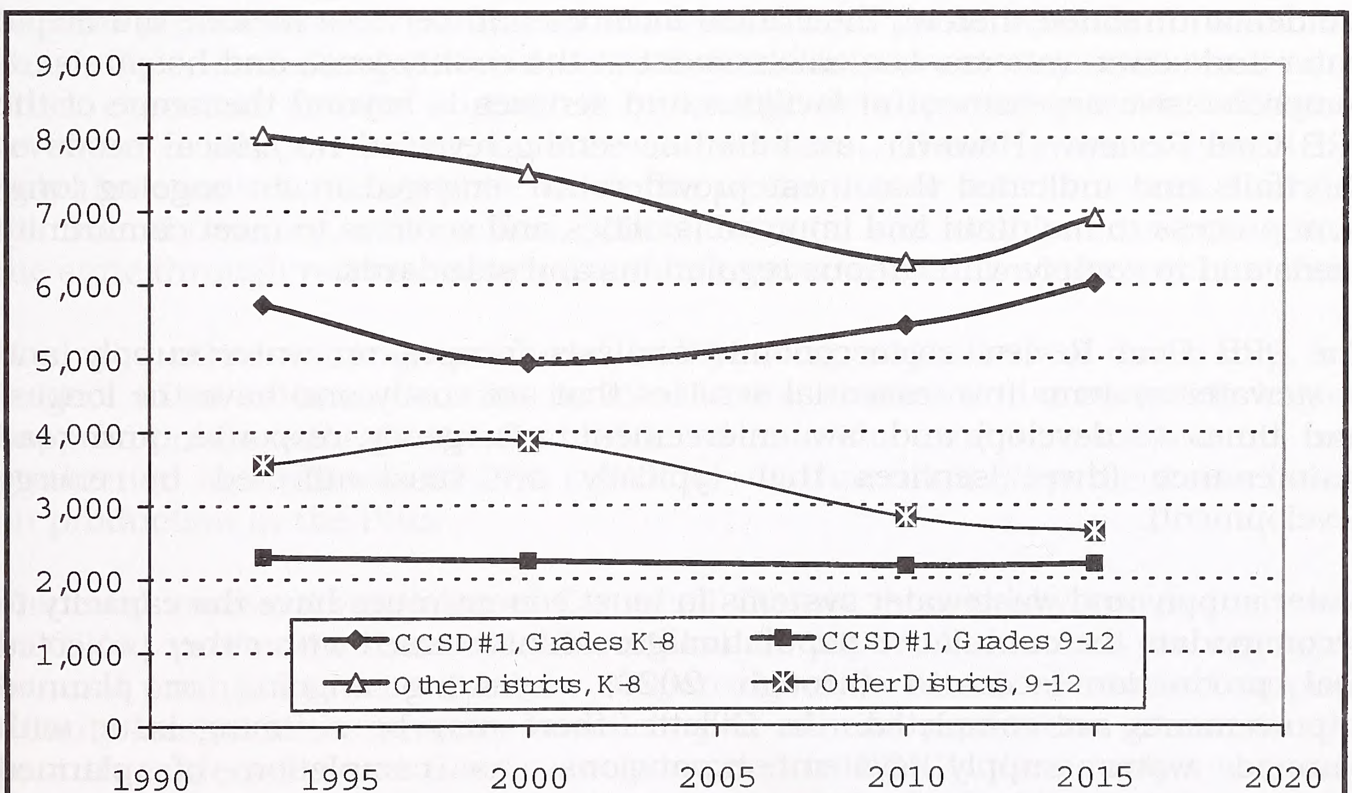
Public school enrollment trends generally mirrored population trends during the period of rapid population growth. District-wide enrollment in Campbell County grew by more than 4,600 students (131 percent) between 1975 and 1985. Enrollment increased in all districts in Converse and Sheridan Counties as well. Enrollment in CCSD #1 subsequently peaked, but remained near record high levels for nearly a decade. Elsewhere in the region enrollments generally declined with a combined enrollment of 9,525 in the other study area districts in 2005, the lowest since 1975 (Wyoming Department of Education 2006). Recent natural gas and mining development has tempered, but not reversed, the trend of declining school enrollments across the region.

Communities across the PRB study area would see population growth due to economic migration from 2003 to 2020; however, the effects of such migration on public school enrollments would vary. As the demographics of the population change, school districts in the PRB would be affected by new trends. In some counties, the size of the school-age population (generally aged five to 17 years)

may even trend in the opposite direction of total population in the short-term due to underlying demographics of the established resident population.

The demographic projections for the two coal production scenarios forecast growth in elementary school enrollments in Campbell County through 2010 and after 2010 for most PRB school districts. Projected enrollments in CCSD #1 would be approximately 10 percent higher by 2020 under the upper coal production scenario, with those in the surrounding districts about 1 percent higher. However, several districts still may experience enrollment levels in 2020 below current levels, as growth from 2010 to 2020 would not offset recent declines or those projected to occur before 2010.

Under the lower coal production scenario, Campbell County would experience an increase of 1,587 students, or 22 percent above recent levels, in school enrollment through 2020. However, the net impact on CCSD #1 would be composed of two trends; a substantial increase in grades K-8 but only small increases in grades 9-12 (figure 4-8). School districts in the surrounding counties are projected to experience declining elementary and middle school enrollments through 2010 and declining high school enrollments through 2015. Thereafter, growth and the associated influences on demographics would generate renewed enrollment growth, particularly in the elementary grades in Johnson, Sheridan, and Converse Counties.



Source: PRB Coal Review Task 3C Report (BLM 2005f)

Figure 4-8. Projected School Enrollment to 2020 Under the Lower Coal Production Scenario.

Under either scenario, projected enrollments may cause short-term school capacity shortages, depending on the specific grade levels and residential

locations of the additional students. Under the Wyoming School Facilities Commission (WSFC) planning guidelines, impacted school districts generally need to accommodate minor capacity shortages through the use of temporary facilities, such as portable classrooms. For larger and more long-term increases, the Commission's policy is to fund capital expansion where warranted by projections developed during updates of school districts' five-year plans. The approved five-year plan for CCSD #1 has a $57.4 million budget covering construction of several new schools and numerous major maintenance and facility upgrade projects. The approved five-year plans for the other school districts have combined cost of $163 million. Capital investment in public education facilities has been a statewide priority in Wyoming for the past decade, with taxes and royalties on mineral and energy resources the primary source of program funding (WSFC 2007 and Wyoming CREG 2007).

4.2.13.7 Facilities and Services

The types and levels of facilities and services provided by local governments reflect service demand, revenue availability, and community values regarding appropriate services and service standards. As with most socioeconomic characteristics, the level and availability of local government facilities and services varies by county and community across the PRB. There are literally several hundred separate service providers in the region. Although virtually all local government facilities and services are affected by energy development and the demand related thereto, the critical facilities and services include municipal water and sewer systems, law enforcement at the county level, and hospitals. A comprehensive assessment of facilities and services is beyond the scope of the PRB Coal Review. However, an initial screening revealed no critical needs or shortfalls and indicated that most providers are engaged in an ongoing long-term process to maintain and improve facilities and services to meet community needs and to comply with various regulations and standards.

The PRB Coal Review socioeconomic analysis focuses on water supply and wastewater systems (two essential services that are costly and have the longest lead times to develop) and law enforcement, emergency response, and road maintenance (three services that typically are most affected by energy development).

Water supply and wastewater systems in most communities have the capacity to accommodate the cumulative population growth associated with either projected coal production scenario through 2020, assuming ongoing or planned improvements are completed. In Gillette, there may be a timing issue with planned water supply system expansions, as completion of planned improvements would occur when substantial growth is anticipated under both projected coal production scenarios. Consequently, Gillette may experience water shortages in the summer months for several years, particularly if growth follows that under the upper coal production scenario. Douglas is looking to add water treatment capacity to provide additional capacity and management flexibility to address needs during times of drought.

The ability to provide desired levels of services to the projected energy-related population and development is less clear in Campbell County, Gillette, Wright, and outlying rural communities. Campbell County and its communities would experience a 25 percent increase in population between 2003 and 2010 under the lower coal production scenario and 30 percent under the upper coal production scenario.

Growth rates and the resultant facility and service demand in other counties within the study area would be substantially less during the 2003 to 2010 period under either scenario; all communities other than Johnson County and Buffalo would grow substantially less than 10 percent during the period. The populations of Johnson County and Buffalo would increase 10 percent by 2010, driven primarily by CBNG development.

Growth rates and resultant increases in service demands would slow substantially during both the 2011 to 2015 and 2016 to 2020 periods under either projected coal production scenario. In most communities except Sheridan County and the city of Sheridan, there would be little difference in population growth and service demand between the two scenarios.

4.2.13.8 Fiscal Conditions

Federal mineral royalties and state and local taxes levied on coal and other mineral production are vitally important sources of public revenue in Wyoming. Taxes, fees, and charges levied on real estate improvements, retail trade, and other economic activity supported by energy development provide additional revenues to support public facilities and services. These revenues benefit not only those jurisdictions within which the production or activity occurs, but also the federal treasury, state coffers, school districts, and local governments across the state through revenue-sharing and intergovernmental transfer mechanisms.

Coal and other minerals produced in Wyoming, regardless of ownership, are subject to ad valorem taxation by local taxing entities and a statewide levy to support public education. Statewide ad valorem taxable valuation on coal production in 2005 was $2,280.1 million. Of that total, 88 percent was based on production in the PRB.

The total assessed valuation of Campbell County, boosted by recent increases in CBNG production, was $4,264 million in 2006. Valuations on aggregate mineral production accounted for 87 percent of that total. Because Campbell County has been the primary beneficiary of mineral production gains over the past three decades and the recent gains tied to CBNG, the county's assessed valuation in 2006 was nearly 38 times that of Weston County ($112.5 million) and 31 times that of Crook County ($137.2 million). The 2006 valuation of 2005 coal production in Campbell County was $1,995.3 million (Wyoming Department of Revenue 2006).

Wyoming levies a severance tax on coal and many other minerals produced in the state. The severance tax rate, levied on the value of production, has varied from 1.0 percent to 10.5 percent over time. The current rate of 7.0 percent was established in 1992. Cumulative statewide severance tax proceeds on coal production since 1970 exceed $2.8 billion. Cumulative severance tax revenues on coal produced in Campbell County total $1.89 billion. Cumulative severance tax revenues for the corresponding period total $96.5 million from Converse County, $60.5 million from Sheridan County, and $758.0 million from the remainder of the state (Wyoming CREG 2007 and Wyoming Department of Revenue 2006).

Producers pay a 12.5 percent royalty to the federal treasury on the value of all surface coal production from federal leases. Total federal mineral royalties of nearly $3.3 billion have been paid on coal produced in Wyoming since 1970, approximately half of which is returned to the state. Estimated 2005 mineral royalties of about $377 million were paid on federal coal produced in the PRB (Minerals Management Service 2006).

At the foundation of the mineral development revenue projections for the period 2003 to 2020 are projected levels of future energy and mineral resource production. The projected total value of annual mineral production under the lower coal production scenario will climb by $3.49 billion (2004 dollars) over 2003 levels, reaching $8.54 billion by 2020, a 69 percent increase over the 2003 value. The aggregate value of energy and mineral resource production under the upper coal production scenario would increase to $9.21 billion in 2020. The incremental difference, compared to the value under the lower coal production scenario, would be $670 million per year, all of which represents the value of higher annual coal output.

The overwhelming majority of future mineral production value is anticipated to be in Campbell County. Over time, the future value of production in Sheridan and Johnson Counties would climb. Total annual mineral production value by 2020 is projected to reach $6.37 billion in Campbell County and $2.17 billion in the surrounding counties. Between 2005 and 2020, total royalty and tax receipts derived from the key selected sources range between $21.1 and $22.6 billion for the lower and upper coal production scenarios, respectively. Receipts derived from coal production would account for the majority of the totals under either scenario, with federal mineral royalties on coal at $4.9 to $5.7 billion being the single largest source. Severance taxes, ranging from $6.3 to $6.7 billion, also would accrue to the state (tables 4-35 and 4-36).

The federal and state governments also benefit from coal lease bonus bids derived from future coal leasing. Bonus bids have risen over time, with successful bids for recent sales ranging from 30 cents per ton to 97 cents per ton. There is no guarantee of that trend continuing. Considerable uncertainty also exists with respect to the timing and scale of future leases, although BLM currently has pending applications for more than four billion tons of federal coal,

Table 4-35. Summary of Mineral Development Tax Revenues Associated with Energy Resource Production Under the Lower Coal Production Scenario (million $).

Industry and Taxes	2005-2010	2011-2015	2016-2020	Total
Coal[1]	$3,164.8	$3,178.9	$3,756.3	$10,100.0
CBNG	$2,915.2	$3,076.4	$3,288.7	$9,280.3
Conventional Oil and Gas	$568.5	$576.4	$614.0	$1,759.0
Totals	**$6,648.5**	**$6,831.7**	**$7,659.0**	**$21,139.3**
Severance Tax	$1,995.9	$2,012.4	$2,249.3	$6,257.6
Federal Mineral Royalties	$2,754.1	$2,839.4	$3,166.3	$8,759.8
State Mineral Royalties	$233.5	$225.8	$251.4	$710.7
Ad Valorem Tax (Counties)	$417.6	$443.0	$502.8	$1,363.3
Ad Valorem Tax (Schools)	$1,247.5	$1,311.1	$1,489.3	$4,047.9
Totals	**$6,648.6**	**$6,831.7**	**$7,659.1**	**$21,139.3**

[1] Does not include coal lease bonus bids due to the uncertainty regarding timing.
Source: PRB Coal Review Task 3C Report (BLM 2005e)

Table 4-36. Summary of Mineral Development Tax Revenues Associated with Energy Resource Production Under the Upper Coal Production Scenario (million $).

Industry and Taxes	2005-2010	2011-2015	2016-2020	Total[1]
Coal[1]	$3,538.0	$3,703.0	$4,350.0	$11,591.0
CBNG	$2,915.2	$3,076.4	$3,288.7	$9,280.3
Conventional Oil and Gas	$568.5	$576.4	$614.0	$1,759.0
Totals	**$7,021.7**	**$7,355.8**	**$8,252.7**	**$22,630.3**
Severance Tax	$2,104.1	$2,159.0	$2,415.4	$6,678.5
Federal Mineral Royalties	$2,946.3	$3,099.9	$3,461.4	$9,507.6
State Mineral Royalties	$233.5	$225.8	$251.4	$710.7
Ad Valorem Tax (Counties)	$435.8	$472.0	$535.0	$1,442.8
Ad Valorem Tax (Schools)	$1,302.3	$1,398.9	$1,589.8	$4,291.0
Totals	**$7,022.0**	**$7,355.6**	**$8,253.0**	**$22,630.6**

[1] Does not include coal lease bonus bids due to the uncertainty regarding timing.
Source: PRB Coal Review Task 3C Report (BLM 2005e)

including this application. The state receives 50 percent of the bonus bid revenue.

Taxes and mineral royalties levied on energy and mineral resource production accruing to the state are disbursed to the Permanent Water Development Trust Fund, Wyoming School Foundation and Capital Facilities funds, capital construction fund for state and local government facilities, and other programs according to a legislatively-approved formula. Through these funds, the revenues derived from resource development benefit the entire state, not just agencies, businesses, and residents of the PRB.

County governments and school districts would realize benefits from future energy and mineral resource development in the form of ad valorem taxes. Such taxes, estimated on the basis of future coal, oil, and natural gas production, are estimated to range between $5.4 billion and $5.7 billion through 2020. Those sums do not include future property taxes levied on the new power plants, expanded rail facilities, or new residential and commercial development associated with future growth, or sales and use taxes levied on consumer and

some industrial purchases. These latter revenues are not estimated in this study, but would be substantially lower than those on resource production.

Local governments would benefit from property taxes on new development, as well as from sales and use taxes on taxable sales within their boundaries. Such revenues are not estimated for this study due to the large number of jurisdictions and other analytical considerations.

4.2.13.9 Social Setting

The past 30 years have seen sweeping social change in the U.S. and throughout much of the world. But in addition to the broad forces that have driven social change in the U.S. as a whole, social conditions in some PRB communities have been substantially influenced by energy development. Factors that have affected social conditions in the PRB include industrial and natural resource development, economic and demographic change, housing and public infrastructure development, and institutional change at the local and state government levels.

One of the key drivers of social change in the PRB has been energy-related population growth. When the first oil boom occurred in the late 1950s, Campbell County was a relatively stable, sparsely-populated rural county. Like many places in Wyoming and throughout the rural west, Campbell County was a small, relatively homogeneous ranching community (ROMCOE 1982). The oil booms of the 1950s and 1960s brought an influx of new people. Development of coal mines, continued oil and gas drilling, and power plant construction precipitated another round of growth. In all, Campbell County population grew by almost 600 percent between 1950 and 2000.

On the one hand, this population growth, combined with a robust economy, generated a variety of positive social effects. Financial and technical resources poured into the community as it mobilized to accommodate the new population. Job opportunities were created in the construction industry, as the community responded to demands for housing, public facilities, and retail goods and services. The large and rapid influx of new residents, eager to take advantage of the employment opportunities, created energy, vitality, and a sense of economic optimism about the community. Where economic advancement had been limited before the boom, there was now opportunity (Gardiner 1985).

On the other hand, it is likely that many residents had mixed feelings about these changes (Heinecke 1985). New residents brought new ideas, new ways of doing things, new preferences for goods and services, and new demands for government services. Some long-time residents, particularly those who were not directly participating in the economic benefits of energy development, viewed these changes as negative.

Today, almost any organization, committee, or government body is made up of a cross-section of energy employees, ranchers, and other community members whose tenure in the community may be long or short (Bigelow 2004, Spencer 2004). Moreover, because of the turnover in the energy companies, the community has become accustomed to newcomers.

Cumulative energy development in the PRB through the year 2020 has the potential to generate both beneficial and adverse effects on community social conditions. Social effects of development activities in the PRB would vary from county to county and community to community under the coal production scenarios developed for this study, based on the existing social setting and the type of development that would occur.

Beneficial social effects would be associated with an expanding economy and employment opportunities associated with energy development and resulting improvements in living standards for those employed in energy-related industries. Adverse social effects could occur as a result of conflicts over land use and environmental values. Negative social effects also could occur if the pace of growth exceeds the abilities of affected communities to accommodate energy-related employees and their families with housing and community services.

In the PRB, social conditions in Campbell County, the city of Gillette, and the town of Wright are most likely to be affected because the county would host much of the cumulative energy development workforce, and the county and its municipalities would receive the largest increments in population growth. Campbell County and its municipalities have a long history of energy development, and they have developed infrastructure and management systems to plan for and manage growth; consequently, major adverse social effects would not be anticipated. However, under either scenario, the county and the two municipalities may face challenges in providing adequate housing and expanding community services in anticipation of population growth through 2010, particularly if several power plant and coal mine construction projects occur simultaneously. As municipalities receive only sales and use tax revenues directly from development and purchases made within their boundaries, Gillette and Wright could face challenges in securing the necessary funding to improve municipal facilities and services. Housing shortages and limitations in public services could contribute to adverse community social effects in these communities.

Many of the people who would immigrate to Campbell County for energy-related jobs are likely to share characteristics with much of the current population; therefore, few barriers to social integration are anticipated.

Social effects on other communities in the PRB are likely to be minimal to moderate. Energy-related population growth is anticipated to be moderate in other communities. Sheridan County, also familiar with coal mining, is the only other county anticipated to host a major construction project under the

development assumptions used for either projected coal production scenario. Converse, Weston, and Crook Counties could experience spillover growth from projects in Campbell County.

Johnson, Sheridan, and Campbell Counties could experience continued conflict over split estate and water issues associated with CBNG development, and the pace and scale of energy development across the PRB is likely to continue to generate social and political conflict over environmental issues under either coal production scenario.

4.2.14 Coal Mining and Coal-Fired Power Plant Related Emissions and By-Products

As discussed in chapter 1, BLM does not authorize mining by issuing a lease for federal coal, but the impacts of mining the coal are considered in this EIS because it is a logical consequence of issuing a maintenance lease to an existing mine. The use of the coal after it is mined is also not determined at the time of leasing, however, almost all of the coal that is currently being mined in the Wyoming PRB is being used by coal-fired power plants to generate electricity. As a result, a discussion of emissions and by-products that are generated by burning coal to produce electricity is included in this section of the EIS.

As discussed in chapter 2, under the currently approved mining plan, which represents the Alternative 1 (No Action alternative), from 2008 on, the Belle Ayr Mine would be able to produce coal at an average production level of 29.0 mmtpy for another 8.6 years under, compared with an average of 29.0 mmtpy for 14.1 years under the Proposed Action, or an average of 29 mmtpy for another 13.9 years under Alternative 2 (table 2-2).

The Coal Creek Mine would be able to produce coal at an average production level of 13.4 mmtpy for another 16.7 years from 2008 on under Alternative 1 (No Action alternative), compared with an average of 13.4 mmtpy for 21 years under the Proposed Action and Alternative 2 (table 2-3).

From 2008 on, the Caballo Mine would be able to produce coal at an average production level of 37.8 mmtpy for another 15.9 years under Alternative 1 (No Action alternative), compared with an average of 37.8 mmtpy for 18.1 years under the Proposed Action, or an average of 37.8 mmtpy for another 18.3 years under Alternative 2 (table 2-5).

The Cordero Rojo Mine would be able to produce coal at an average production level of 46.3 mmtpy for another 5.9 years from 2008 on under Alternative 1 (No Action alternative), compared with an average of 46.3 mmtpy for 15.3 years under the Proposed Action, or an average of 46.3 mmtpy for another 15.9 years under Alternatives 2 and 3 (table 2-7).

Section 3.4.5 contains estimates of greenhouse gas emissions resulting from the combined mine operations at the Belle Ayr, Coal Creek, Caballo, and Cordero

Rojo Mines from projected operations under the proposed action and alternatives.

4.2.14.1 Global Climate Change and Greenhouse Gas Emissions

Ongoing scientific research has identified the potential impacts of anthropogenic (man-made) GHG emissions and changes in biological carbon sequestration due to land management activities on global climate. Emissions of GHG's are typically reported as equivalent CO_2 (CO_2e), which is the amount of the gas emitted, multiplied by its warming potential relative to CO_2. Through complex interactions on a regional and global scale, these changes cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat radiated by the earth back into space. Although GHG levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused CO_2 and other GHG concentrations to increase dramatically, and are likely to contribute to overall global climatic changes. As with any field of scientific study, there are uncertainties associated with the science of climate change. This does not imply that scientists do not have confidence in many aspects of climate change science. Some aspects of the science are known with virtual certainty, because they are based on well-known physical laws and documents trends (EPA 2008a).

Climatic change analyses are comprised of several factors, including GHG emissions, land use management practices, and the albedo effect. In chapter 3, the effects of recent global climate change on the environment in the area of the proposed action have been identified. It is assumed that existing land and resource conditions within the analysis area have been and will continue to be affected by climate change under all alternatives. Existing climate prediction models are not at a scale sufficient to estimate potential impacts of climate change within the Powder River Basin. Reference has been made to national and regional data that is available, including the recent comprehensive report, *The Effects of Climate Change on Agriculture, Land Resources, Water Resources and Biodiversity in the United States* (U.S. Climate Change Science Program, 2008).

Tools necessary to quantify incremental climatic changes associated with those factors for the projected development activities in the PRB are presently unavailable. As a consequence, quantitative impact assessments of the effects of specific anthropogenic activities cannot be performed. In addition, the scientific community simply does not have the tools at the present time to evaluate any potential impacts of this kind given the spatial and temporal scales involved. Additionally, specific levels of significance have not yet been established. Therefore climate change analysis in this EIS is limited to accounting for and disclosing of factors that contribute to climate change. To the extent that emission data were available or could be inferred from representative type data, potential GHG emissions that could result from development of the proposed LBAs have been identified, as well as emissions that will result from selection of the no action alternative.

In the following analysis, the contribution of the proposed LBAs to cumulative effects on the environment of historic and projected development activity is evaluated. To do this, it is assumed that coal mining will proceed in accordance with permit conditions. It is further assume that this coal will be sold to coal users in response to forecasts of demand for this coal. Historically these users have been electric utilities in the United States, although there is potential for sales outside the U.S. This coal market is open and competitive and users can buy from the most cost effective suppliers that meet their needs. The BLM does not determine the destination of this coal, and the use of the coal is determined by the coal consumer. The electric utilities where this coal has historically been used are throughout the United States, and have a variety of coal combustion technologies and emission control, but all are licensed by the appropriate regulatory authorities and operate under necessary permit requirements, and in compliance with regulation.

Assuming that all coal produced would be burned to generate electricity, the amount of GHG emissions that could be attributed to coal production that could result from leasing of the proposed LBAs, as well as from the forecast coal production from all coal mines in the Wyoming PRB has been estimated. This was done by relating the portion of coal mined to the total emission of GHG from all coal mined in the U.S. It is assumed that all PRB coal was used for coal fired electric generation as part of the total U.S. use of coal for electric generation. This gives an upper estimate of the GHG resulting from use of the coal that would be produced from the proposed LBAs, and for forecast total PRB coal production. Specific levels of significance have not yet been established for GHG emissions, and given the state of the science, it is not yet possible to associate specific actions with the specific climate impacts. Since tools necessary to quantify incremental climatic changes associated with these GHG emissions are presently unavailable, the analysis cannot reach conclusions as to the magnitude or significance of the emissions on climate change. The impacts of climate change represent the cumulative aggregation of all worldwide GHG emissions, land use management practices, and the albedo effect. The analysis does provide a meaningful context and measure of the relative significance of coal use from the proposed LBAs and overall projected PRB coal production on total GHG emissions.

The National Assessment of the Potential Consequences of Climate Variability and Change, an interagency effort initiated by Congress under the Global Change Research Act of 1990, Public Law 101-606, has confirmed that climate change is impacting some natural resources that the Department of the Interior has the responsibility to manage and protect (DOI 2001). The Synthesis Report, the final part of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) (available online at http://www.ipcc.ch), was released in preliminary form on November 17, 2007. The Synthesis Report (Bernstein et al. 2007) summarizes the results of the assessment carried out by the three working groups of the IPCC. Observations and projections addressed in the report include:

- "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperature, widespread melting of snow and ice, and rising global average sea level."
- "Observational evidence from all continents and most oceans show that many natural systems are being affected by regional climate changes, particularly temperature increases."

From 1850 to present, historic trend data show an increase of 1°C (1.8°F) in global mean temperature. The increase has not been linear over time, and there have been extended periods (decades) where temperature has dropped or stayed constant. This historic warming over that same period has caused sea levels to rise by about 20 cm (7.9 inches) on average, and has also resulted in changes in climate patterns on land. These changes are not uniform. In some areas near the equator, temperatures have cooled by about 5°C (9°F), while closer to the poles, temperatures have risen by equal amounts (Hansen and Lebedeff 1987). In northern latitudes (above 24° N), temperature increases of nearly 1.2°C (2.1°F) have been documented since 1900. Temperature changes can result in shifts of weather patterns (rainfall and winds) which may then affect vegetation and habitat. It is important to note that GHGs will have a sustained climatic impact over different temporal scales (EPA 2008a).

Solar variability may play a role in global climate change, though the magnitude of the influence of increased sun activity is not well understood. Physical aspects of the sun, like sunspots and solar radiation output, are known to vary over time. The intensity of energy from the sun has varied through time and has resulted in global temperature variation.

Human population doubled to two billion from the period 1780 to 1930, then doubled again by 1974. The atmospheric concentrations of greenhouse gases have increased as human populations have increased. More land and resources were used to provide for the needs of these populations. As human activities have increased, carbon-based fuels have been used to provide for those additional energy needs. Forests and vegetation were cleared in order to provide for food production and human use.

CO_2, methane (CH_4), water vapor, ozone, and nitrous oxide (N_2O) are recognized as the major greenhouse gases, although there are other gases that are considered GHGs. Through complex interactions on a regional and global scale, these GHG emissions and net losses of biological carbon sinks have had a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Like glass in a greenhouse, these gases trap radiation from the sun and act as an insulator around the Earth, holding in the planet's heat.

According to the IPCC's synthesis report (Bernstein et al. 2007):

- "Global atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years."
- "Most of the observed increase in globally-averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations. It is likely there has been significant anthropogenic warming over the past 50 years averaged over each continent (except Antarctica)."
- "There is high agreement and much evidence that with current climate change mitigation policies and related sustainable development practices, global greenhouse gas emission will continue to grow over the next few decades."
- "Continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would be very likely to be larger than those observed during the 20th century."
- "There is high confidence that by mid-century, annual river runoff and water availability are projected to increase at high latitudes and in some tropical wet areas and decrease in some dry regions in the mid-latitudes and tropics. There is also high confidence that many semi-arid areas (e.g., Mediterranean Basin, western United States, southern Africa and northeast Brazil) will suffer a decrease in water resources due to climate change."
- "Anthropogenic warming and sea level rise would continue for centuries due to the time scales associated with climate processes and feedbacks, even if greenhouse gas concentrations were to be stabilized."
- "Anthropogenic warming and sea level rise could lead to some impacts that are abrupt or irreversible, depending upon the rate and magnitude of the climate change."
- "There is high agreement and much evidence that all stabilization levels assessed can be achieved by deployment of a portfolio of technologies that are either currently available or expected to be commercialized in coming decades, assuming appropriate and effective incentives are in place for their development, acquisition, deployment and diffusion and addressing related barriers."

The National Academy of Sciences has confirmed these findings, but also has indicated there are uncertainties regarding how climate change may affect different regions. Computer model predictions indicate that increases in temperature will not be equally distributed, but are likely to be accentuated at

higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures is more likely than increases in daily maximum temperatures. Increases in temperatures would increase water vapor in the atmosphere, and reduce soil moisture, increasing generalized drought conditions, while at the same time enhancing heavy storm events. Although large-scale spatial shifts in precipitation distribution may occur, these changes are more uncertain and difficult to predict (EPA 2008a).

Relatively steep elevation gradients between valley floors and adjacent mountain ranges in the western U.S. produce considerable geographic climate variability. Warm, dry, semiarid conditions are typical on valley floors; moist and cool conditions are typical in higher parts of mountain ranges. Different plant communities occur within specific elevation zones. There also have been patterns of historic climatic variation in these areas for more than 10,000 years, during which plant communities gradually shift to higher or lower elevations depending on the direction of temperature and precipitation changes (Tausch et al. 2004).

If global warming trends continue into the foreseeable future, Chambers (2006) and the 2008 report by the U.S. Climate Change Science Program (U.S. Climate Change Science Program, 2008) indicate that the following changes may be expected to occur in the West:

- The amount and seasonal variability of precipitation will increase over most areas. IPCC (2001) climate model scenarios indicate that by 2100, precipitation will increase about 10 percent in summer, about 30 percent in fall, and 40 percent in winter. Less snowfall will accumulate in higher elevations, more precipitation will occur as rain, and snowmelt will occur earlier in the spring because of higher temperatures.

- Streamflow patterns will change in response to reduced snowpacks and increasing precipitation. Peak flows in spring are expected to occur earlier and be of lower magnitude because of snowpack changes. Runoff from greater amounts of winter rainfall will cause higher winter flows. Summer flows will be lower, but with higher variability depending on the severity of storm events.

- Some populations of native plants, invasive species, and pests will expand. Increasing amounts of atmospheric carbon dioxide. and precipitation during the growing season will provide favorable growth conditions for native grasses, perennial forbs, woody species, and invasive annuals such as cheatgrass. Insect populations also will likely increase because milder winter temperatures will improve reproduction and survival rates.

- Fire frequency, severity, and extent will increase because of the increased availability of fine fuels (grasses, forbs, and invasives) and accumulation of fuels from previous growing seasons. Higher temperatures will extend the

length of fire seasons. Expansion of pinyon-juniper species and increasing tree densities could increase the number of high severity crown fires. Higher rates of insect damage and disease also may increase fuel accumulations.

- Sensitive species and overall biodiversity will be reduced. High-elevation habitats will shrink in area or disappear as lower-elevation plant communities expand. It is probable that some mammalian, avian, and other species that currently inhabit these high-elevation habitats may become extinct. Higher rates of disease and insect damage also may pose threats to other sensitive plant and animal species.

In 2006, transportation sources accounted for approximately 29 percent of total U.S. greenhouse gas emissions (EPA 2008b). Transportation is the fastest growing source of U.S. GHGs, accounting for 47 percent of the net increase in total U.S. emissions since 1990 (EPA 2008a). Transportation is also the largest end-use source of CO_2, which is the most prevalent anthropogenic GHG (EPA 2008b, NOAA 2009).

Historically, the coal mined in the PRB has been used as one of the sources of fuel to generate electricity in power plants located throughout the United States. Coal-fired power plant emissions include CO_2, which has been identified as a principal anthropogenic greenhouse gas. According to the Energy Information Administration (USDOE 2007a, 2007b):

- CO_2 emissions represent about 84 percent of the total U.S. greenhouse gas emissions.

- Estimated CO_2 emissions in the U.S. totaled 5,934.2 million metric tons in 2006, which was a 1.8 percent decrease from 2005.

- Estimated CO_2 emissions from the electric power sector totaled 2,343.9 million metric tons, or about 39.5 percent of total U.S. energy-related CO_2 emissions in 2006.

- Estimated CO_2 emissions from coal electric power generation in 2005 totaled 1,937.9 million metric tons or about 33 percent of total U.S. energy-related CO_2 emissions in 2006.

- Coal production from the Wyoming PRB represented approximately 42 percent of the coal used for power generation in 2006, which means that Wyoming PRB surface coal mines were responsible for about 13.9 percent of the estimated U.S. CO_2 emissions in 2006.

Wyoming PRB coal is shipped primarily nationwide, although it can also be shipped overseas. The mines in the Powder River Basin have sold, and are expected to sell coal into the open coal market. Each mine's ability to sell coal in this market will determine annual production rates at that mine. Historically,

the coal buyers have been domestic electric producers, although the coal could be used in other coal applications and it has been exported.

Relatively little PRB coal, about 2 percent, is burned in Wyoming. In 2005, Wyoming coal was shipped to 35 states besides Wyoming. As noted above, coal represented 50.2 percent of the fuel mix used by electric generators nationally in 2004. In the NERC (North American Electric Reliability Corporation) power regions where PRB coal is sold, coal use ranges from 74.2 percent in the upper Midwest, to 15.6 percent in the northeast U.S. (EPA 2007e).

There are methods of generating electricity that result in fewer greenhouse gas emissions than burning coal, including natural gas, nuclear, hydroelectric, solar, wind, and geothermal resources. However, coal-burning power plants currently supply about 50 percent of the electric power generated in the U.S. The demand for power is increasing in the U.S. and throughout the world. According to a recent report by the North American Electric Reliability Council, peak demand for electricity in the U.S. is expected to double in the next 22 years (Associated Press 2007). Many developing countries, including China and India, are also relying heavily on coal to meet their rapidly increasing power demands as coal is more economical and more available than other sources of electrical generation.

Coal sales are made on short term contracts, generally to individual power generators, or coal is sold on a spot market. This market is very dynamic and competitive. During the coal leasing EIS process, it is uncertain and speculative to predict who might purchase future PRB coal, how it would be used, and where the coal might be transported to.

Technologies for producing cleaner, more efficient and more reliable power from coal are becoming more available, although not yet commercially established. These include advanced pulverized coal, circulating fluidized bed, and integrated gasification combined cycle (IGCC) technologies. The FutureGen project proposes to produce electricity by turning coal into gas, remove impurities, extract CO_2 from the waste stream, and then sequester the CO_2 underground. A site in southeastern Illinois was recently selected for the plant, which has a goal of being operational in 2012 (Biello 2007). FutureGen is a public-private partnership between the USDOE and the FutureGen Industrial Alliance, Inc., a non-profit consortium of international energy companies. The Alliance is responsible for design, construction, and operation of the facility, and USDOE is responsible for independent oversight and coordinating participation of international governments. Under a cooperative agreement between USDOE and the Alliance, USDOE was to provide a majority of the project's cost. On January 30, 2008, USDOE proposed a major restructuring of the FutureGen project and that financing part of FutureGen at this time would be inappropriate. However, the full Senate Appropriations Committee passed legislation in July 2008 to protect $134 million of previously appropriated federal funding slated for FutureGen to keep the project moving forward (FutureGen 2008).

At this time, there is no national policy or law in place that regulates GHG emissions. A number of bills were introduced in the U.S. Congress in 2007 related to global climate change. The Lieberman-Warner Climate Security Act, which was introduced in October, 2007 by Senators Joseph I. Lieberman (ID-CT) and John W. Warner (R-VA), would establish a cap-and-trade within the United States. In short, the "cap" would set a legal limit on the quantity of greenhouse gases that a region can emit each year and "trade" would allow companies to exchange the permission – or permits – to emit greenhouse gases. This program would require a 70 percent reduction in greenhouse gas emissions from covered sources, which represents over 80 percent of total U.S. emissions. It was voted out of the Senate Environment and Public Works Committee in December, 2007 (http://www.pewclimate.org, accessed 12/21/2007). The last action on the bill was on May 20, 2008 when it was placed on the Senate Legislative Calendar under General Orders. Calendar No. 740. President Obama, in an address to Congress in February 2009, advocated congressional action on a cap-and-trade program.

Additionally, in 2007, the U.S. Supreme Court (Massachusetts v. EPA) held that CO_2 qualifies as an air pollutant under the Clean Air Act (CAA) Section 302(g). The case was remanded to EPA to take further action to regulate CO_2 under the CAA unless the EPA determines that CO_2 does not endanger public health or welfare. On April 17, 2009, the Administrator of the EPA signed a proposal with two distinct findings regarding greenhouse gases under section 202(a) of the Clean Air Act. The Administrator is proposing to find that the current and projected concentrations of the mix of six key greenhouse gases - CO_2, CH_4, N_2O, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6)—in the atmosphere threaten the public health and welfare of current and future generations. This is referred to as the endangerment finding. The Administrator is further proposing to find that the combined emissions of CO_2, CH_4, N_2O, and HFCs from new motor vehicles and motor vehicle engines contribute to the atmospheric concentrations of these key greenhouse gases and hence to the threat of climate change. This is referred to as the cause or contribute finding. This proposed action, as well as any final action in the future, would not itself impose any requirements on industry or other entities. An endangerment finding under one provision of the Clean Air Act would not by itself automatically trigger regulation under the entire Act. The EPA is accepting comment on this proposed action for 60 days (EPA 2009d).

Federal, state, and local governments are also developing programs and initiatives aimed at reducing energy use and emissions. The 2002 Clear Skies and Global Climate Change Initiative is a voluntary national program to reduce greenhouse gas emissions. There are federal tax incentives for energy efficiency and conservation, and some states have renewable energy and energy efficiency policies. Regional initiatives have been started in the northeast (Northeast Regional Greenhouse Gas Initiative) as well as the Western Climate Initiative in the western states. At this time, it is not possible to predict how all of these programs would be melded into a national regulatory process if one were to be enacted.

A number of U.S. financial and corporate interests have acknowledged that enactment of federal legislation limiting the emissions of CO_2 and other greenhouse gases seems likely (NARUC 2007). There is uncertainty about anticipated CO_2 emission limits and carbon capture/sequestration regulations. This has caused some proponents to cancel or delay their proposed projects that use existing and emerging technologies to produce electricity from coal (Casper Star Tribune 2007c, 2007d).

The regulatory mechanisms proposed under the Climate Security Act, as well as the past regulation of other pollutants under the CAA, are imposed at the point when coal is burned and converted to electric energy and by-products like CO_2. Over 95 percent of coal produced in the PRB is sold in an open market where coal is purchased on short term contracts or spot prices based on a coal feed stock that is suitable for each buyer's power generating facility. Coal production at any one mine is not tied in any predictable way over a period of time to any one power plant. Power plant buyers attempt to buy coal from suppliers at the most economical prices that meet their needs. PRB coal has competed well in this market due to its low sulfur content. This makes it valuable in lowering sulfur dioxide pollution, as well as competitive mining costs when compared to delivered costs of coal from other coal producing areas.

U.S. coal production increased from 1,029.1 million tons in 1990, when the Powder River federal coal region was decertified, to 1,161.4 million tons in 2006, an increase of 12.9 percent (USDOE 2007b). Wyoming coal production increased from 184.0 million tons in 1990 to 444.9 million tons in 2006, an increase of 242 percent (Wyoming Department of Employment 2007a). The share of electric power generated by burning coal was consistently around 50 percent during that time frame. Also, the percentage of total U.S. CO_2 emissions related to coal consumption was consistently around 36 percent during that same time frame. The percentage of U.S. CO_2 emissions related to the coal electric power sector increased from about 31 percent in 1990 to about 33 percent in 2006 (USDOE 2007a, 2007b).

In 2006, the Wyoming Powder River Basin coal mines produced approximately 432.0 million tons of coal. Using factors derived from laboratory analyses, it is estimated that approximately 716.9 million metric tons of CO_2 would be generated from the combustion of all of this coal (before CO_2 reduction technologies are applied). This number is based on an average Btu value of 8,600 per pound of Wyoming coal and using a CO_2 emission factor of 212.7 pounds of CO_2 per million Btu (USDOE 1994). The estimated 716.9 million metric tons of CO_2 represents approximately 33.6 percent of the estimated 2,134.1 million metric tons of U.S. CO_2 emission from coal combustion (USDOE 2007a). In 2006, Wyoming PRB mines accounted for approximately 37.2 percent of the coal produced in the U.S (USDOE 2007c).

Table 4-37 Estimated Annual Equivalent CO_2 Emissions at Mines with Pending LBAs, shows the estimated cumulative annual CO_2e emissions produced by all mines in the PRB which currently have LBAs pending. The cumulative

Table 4-37. Estimated Annual Equivalent CO_2 Emissions* from Coal Production at Mines With Pending LBAs.

Source	2007	With LBA Tracts
SGAC Mines/LBA Tracts	0.716	1.182
WAC Mines/LBA Tracts	1.245	2.503
Antelope Mine/West Antelope II Tract	0.225	0.348
Buckskin Mine/Hay Creek II Tract	0.197	0.197
Total	**2.535**	**4.229**

* Equivalent CO_2 in million metric tons
Source: BLM 2008g, IML Air Science 2009, WWC 2009a, WWC 2009b

emissions calculated are those associated with the actual mining operations and not from the combustion of the coal produced and sold on the open coal market. The LBAs are addressed individually in the following EISs: The SGAC EIS, the WAC EIS, the West Antelope II EIS, and the Hay Creek II EIS.

Wyoming coal production has increased at a more rapid rate than other domestic coal. Wyoming coal is low in sulfur, providing a way for electric generators to achieve acid rain reduction requirements. Coal coming out of the Wyoming PRB is mined using surface mining methods which are generally safer and less labor intensive than underground mining. Rural rangelands are the areas that are mainly mined; they are reclaimed according to WDEQ/LQD's standards (see section 3.9.4). PRB coal reserves are in thick seams, resulting in more production from areas of similar land disturbance, and lower mining and reclamation costs.

As discussed earlier in this chapter, future coal mining impacts are estimated based on two forecast scenarios for PRB coal production through 2020. In the low scenario, the percentage of coal use for electric generation would stay about the same, assuming that all forms of electric generation would grow at a proportional rate to meet forecast electric demand. In the high scenario, percentage of coal use would also remain about the same, but with PRB coal displacing coal from other domestic coal regions.

If public sentiment results in changed electric demand, or if GHG emissions are ultimately regulated, the demand forecast for coal for electric generation could change. The USDOE has forecasted that by 2030, the coal share of total energy use will increase from 23 percent in 2006 to 25 percent in 2030, while the share of natural gas will fall from 22 percent to 20 percent, and the liquids share is predicted to fall from 40 percent to 37 percent. The combined share of carbon-neutral renewable and nuclear energy is forecasted to grow from 15 percent in 2006 to 17 percent in 2030.

Taken together, projected growth in the absolute amount of primary energy consumption and a shift toward a fuel mix with slightly lower average carbon content will cause projected energy-related emissions of CO_2 to grow by 16 percent from 2006 to 2030. This is slightly lower than the projected 19 percent increase in total energy use. Over the same period, the economy becomes less carbon-intensive, because the 16 percent increase in CO_2 emissions is about

one-fifth of the projected increase in GDP (79 percent), and emissions per capita decline by 5 percent.

In the 2008 study, projected energy-related CO_2 emissions grew from 5,890 million metric tons in 2006 to 6,851 million metric tons in 2030. In the Annual Energy Outlook 2008 study, energy-related CO_2 emissions were projected to grow by about 35 percent, to 7,950 million metric tons in 2030. This reflects both a higher projection of overall energy use and, to a lesser extent, a different mix of energy sources (USDOE 2008c). This forecast is within the range of the high and low scenarios presented in chapter 4.

The Annual Energy Outlook 2008 report projected that energy-related emissions of CO_2 will grow by 16 percent from 2006 to 2030. In this projection, the mix of sources for this generation include coal, natural gas, nuclear, liquids (petroleum), hydro-power, and non-hydro renewable (wind, solar, etc.). The forecasted generation mix by 2030 as compared to 2007 is included in table 4-38.

Table 4-38. Projected Percent of CO_2 Emissions by Source (2007 and 2030).

Source	2007	2030
Coal	51%	58%
Nuclear	21%	19%
Natural Gas	18%	11%
Petroleum	1%	1%
Hydro Power	7%	6%
Renewables	2%	5%

The Electric Power Research Institute (EPRI) attempted to identify a scenario of how the full portfolio of technologies to provide for electric energy would respond if national policy were to require that CO_2 emissions be reduced to 1990 levels (James 2007). As noted earlier, there is no regulatory structure or CO_2 emission levels or limits that have been set by national policy or law yet. This scenario provides some analysis of the possible effect of regulation as well as decreased demand through energy efficiency at the user end, in transmission, and at the producer end. The forecasted generation mix by 2030 as compared to 2007 is included in table 4-39.

Table 4-39. Projected Percent of CO_2 Emissions by Source (2007 and 2030) Under a Reduced CO_2 Emissions Scenario.

Source	2007	2030
Coal	51%	52%
Nuclear	21%	29%
Natural Gas	18%	5%
Petroleum	1%	0%
Hydro Power	7%	5%
Renewables	2%	9%

The EPRI study predicts that national policy that forces a reduction of CO_2 emissions to 1990 levels would promote increased energy efficiency, and the growth of "non carbon" sources such as nuclear and renewable. Renewable sources include wind and solar, as well as emerging technologies like tidal power, river turbines and others reported in the media. Hydropower is limited because most opportunities for hydropower have been used or require large infrastructure. Use of carbon based sources such as gas and petroleum are less than forecasted by the Energy Information Administration (EIA), while coal use remains about the same in the EPRI forecast, mostly due to forecasted improvement in GHG emission reduction in coal fueled generation. Both EIA and EPRI forecast increases in electricity cost.

The mines in the Powder River Basin have sold and are expected to sell coal into the open coal market. In both EIA market projections and market projections that contemplate CO_2 regulation, the coal market supplies half or more of the electric generation mix through 2020. Each mine's ability to sell coal in this market will determine annual production rates at that mine. Historically, the coal buyers have been domestic electric producers, although the coal could be used in other coal applications or be exported.

The SGAC Mines produced 100.1 million tons of coal in 2006, which represents about 22.7 percent of the coal produced in the Wyoming PRB accounting for about 3.2 percent of the estimated U.S. CO_2 emissions in that year. Under the No Action alternative, CO_2 emissions attributable to burning coal produced by the Belle Ayr, Coal Creek Caballo, and Cordero Rojo Mines would be extended at about this level for up to approximately 16 years, while the mines recover their remaining estimated 1,564 million tons of currently leased coal reserves. It is likely that, by that time, regulations limiting CO_2 emissions will be in place and, potentially, projects utilizing the emerging technologies to reduce and/or sequester CO_2 emissions would be more established.

Section 3.18.2 contains estimates of greenhouse gas emissions resulting from the specific mine operations at the Belle Ayr, Coal Creek Caballo, and Cordero Rojo Mines from projected operations under the Proposed Actions and alternatives.

Under the Proposed Action and Alternatives 2 and 3, the Belle Ayr, Coal Creek Caballo, and Cordero Rojo Mines anticipate producing the coal included in the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts, respectively, at currently permitted levels using existing production and transportation facilities, which would extend CO_2 emissions related to burning coal from the applicant mines for up to just over 10 additional years beyond July 2008. It is not possible to project the level of CO_2 emissions that burning the coal in the SGAC LBA tracts would produce due to the uncertainties about what emission limits will be in place at that time or where and how the coal in the SGAC LBA tracts would be used after it is mined. It is not likely that selection of the No Action alternatives would result in a decrease of U.S. CO_2 emissions attributable to coal-burning power plants in the longer term because there are

multiple other sources of coal that, while not having the cost, environmental, or safety advantages, could supply the demand for coal beyond the time that the Belle Ayr, Coal Creek Caballo, and Cordero Rojo Mines complete recovery of the coal in their existing leases.

CBNG, which is composed primarily of methane, another greenhouse gas, is released into the atmosphere when coal is mined. According to the U.S. Energy Information Administration (USDOE 2007a and 2007b):

- U.S. anthropogenic methane emissions totaled 605 million metric tons CO_2e) in 2006.
- U.S. 2006 methane emissions from coal mining were estimated at 64.7 million metric tons CO_2e, which represents approximately 10.7 percent of the U.S. total anthropogenic methane emissions in 2006.
- Surface coal mining operations in the U.S. were estimated to be responsible for methane emissions of about 14.2 million metric tons of CO_2e in 2006, which represents about 2.35 percent of the estimated U.S. anthropogenic methane emissions in 2006, and about 22 percent of the estimated methane emissions attributed to coal mining of all types.
- The Wyoming PRB produced approximately 53.7 percent of the coal mined in the U.S. in 2006 using surface mining techniques, which means that Wyoming PRB surface coal mines were responsible for approximately 1.26 percent of the estimated U.S. anthropomorphic methane emissions in 2006. The three Wright Area coal mines contributed about 52 percent of the Wyoming PRB production in 2006.

Since 1990, when BLM began leasing using the lease by application process, total U.S. anthropogenic methane emissions declined from 708.4 million metric tons CO_2 equivalent to 605.1 million metric tons CO_2 equivalent in 2006. Total coal mining related emissions declined from 97.7 million metric tons CO_2 equivalent to 64.7 million metric tons CO_2 equivalent during the same time period. The Energy Information Administration (USDOE 2007b) attributes the overall decrease in coal mine emissions of methane since 1990 to the fact that the coal production increases during that time had been largely from surface coal mines that produce relatively little methane.

CBNG is currently being commercially produced by oil and gas operators from wells within and near the SGAC LBA tracts. CBNG that is not recovered prior to mining would be vented to the atmosphere during the mining process. Selection of the No Action alternatives would potentially allow more complete recovery of the CBNG from the SGAC LBA tracts in the short term (ten years), during the time that the mine's currently leased coal is being recovered. However, BLM's analysis suggests that a large portion of the CBNG resources that are currently present on the tract would be recovered prior to mining under the Proposed Action or Alternatives 2 or 3. Selection of the No Action alternatives (Alternative

1) would not be likely to directly decrease U.S. methane emissions attributable to coal mining in the long term because there are multiple other sources of coal that could supply the coal demand beyond the time that the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines recovers the coal in their existing leases.

4.2.14.2 Mercury, Coal Combustion Residues, and Other By-Products

To meet the nationwide consumer demand and requirement for energy, coal is burned in power plants to produce electricity for the United States. Coal is an important component of the U.S. energy supply partly because it is the most abundant domestically available fossil fuel (USGS 2002b). One-quarter of the world's coal reserves are found within the United States (USDOE 2008c); the energy content of U.S. coal resources exceeds that of all the world's known recoverable oil (USDOE 2008c). Coal resources supply more than half of the electricity consumed by Americans (USDOE 2008c). Many countries are even more reliant on coal for their energy needs than is the United States (USGS 2000). More than 70 percent of the electricity generated in China and India comes from coal (USGS 2000). The value of coal is partially offset by the environmental impacts of coal combustion (USGS 2000). As described below, some of these impacts may have direct or indirect effects on human health (USGS 2000).

One of the concerns associated with burning coal for electricity production is the release of elements from coal to the environment (USGS 2002b). When coal is burned, carbon dioxide, sulfur dioxide, nitrogen oxides, and mercury are released (EPA 2009e). The principal pollutants generated by coal combustion that can cause health problems are particulates, sulfur and nitrogen oxides, trace elements (including arsenic, fluorine, selenium, and radioactive uranium and thorium), and organic compounds generated by incomplete coal combustion (USGS 2000).

In coal combustion, concentrations of these elements and compounds vary depending on the chemistry of the coal deposits and on the type of air pollution controls in place when the coal is burned. Coal use in developing countries can potentially cause serious human health impacts (USGS 2000). Some coal mined in China is known to have caused severe health problems in several local populations because the coal was mined and burned with little regard to its chemical composition (USGS 2000). Chinese coals that contained high levels of arsenic, fluorine, selenium, and polycyclic aromatic hydrocarbons have caused severe, life-threatening health impacts to some residents that burned the coal in unvented stoves in their homes (USGS 2000).

Coal that is burned in the U.S. generally contains low to modest concentrations of potentially toxic trace elements and sulfur (USGS 2000). Specifically, Powder River Basin coal is recognized as being a clean burning coal due to its low sulfur and low ash properties. In a 2002 analysis conducted by USGS (2002b), PRB coal was found to contain, on average, approximately 8 times less sulfur than coals being utilized from the Appalachian and Illinois basins to supply U.S.

power plants (feed coal). PRB feed coal was also found to contain nearly half as much uranium (8.9 ppm), 7 times less arsenic (17 part per million [ppm]), 5 times less lead (19 ppm), and 3 times less cadmium (1.1 ppm) as compared to Appalachian and Illinois basin feed coals. When burned, PRB coal produced, on average, 38 percent less fly ash than Appalachian and Illinois basin coals (USGS 2002b). The fly ash resulting from combusted PRB coal contained approximately 39 times less mercury than fly ash that was generated from combusted Appalachian and Illinois basin coal (USGS 2002b).

Additionally, many U.S. coal burning power plants use sophisticated pollution-control systems that efficiently reduce the emission of hazardous elements (USGS 2000). The EPA conducted a detailed study of possible health impacts from exposure to emissions of approximately 20 potentially toxic substances from U.S. coal-burning power plants (USGS 2000). The EPA concluded that, with the exception of possibly mercury, there is no compelling evidence to indicate that emissions from U.S. coal-burning power plants cause human health problems (USGS 2000).

Mercury is a naturally occurring element and enters the environment as a result of natural sources, such as active volcanoes, and through human activities such as industrial combustion and mining (EPA 2006). Natural sources of mercury, such as volcanic eruptions and emissions from the ocean, have been estimated to contribute about 33 percent of the current worldwide mercury air emissions; anthropogenic (human-caused) mercury emissions account for the remaining 67 percent, though these estimates are highly uncertain (EPA 2009f).

When fossil fuels burn, mercury vapor can be released into the atmosphere where it may drift for a year or more, spreading with air currents over vast regions of the globe (USDOE 2006a). In 1995, an estimated 5,500 tons of mercury was emitted globally from both natural and human sources (USDOE 2006a). Coal-fired power plants in the United States contributed to less than 1 percent of that total (USDOE 2006a).

Mercury is a global problem that knows no national or continental boundaries. It can travel thousands of miles in the atmosphere before it is eventually deposited back to the earth in rainfall or in dry gaseous forms (EPA 2009d). EPA estimates that about one-third of the U.S. anthropogenic mercury emissions are deposited within the contiguous U.S. and the remainder enters the global cycle (EPA 2009f).

Table 4-40 summarizes how the various continents contributed to the worldwide anthropogenic mercury emissions in 2004. The 2004 U.S. anthropogenic mercury emissions were estimated to account for about 3 percent of the global total (2009f). EPA (2006) estimates that 83 percent of the mercury deposited in the U.S. originates from international sources, with the remaining 17 percent coming from the U.S. and Canada. These figures include mercury from natural and anthropogenic sources.

Table 4-40. 2004 Percent Contribution to Worldwide Anthropogenic Mercury Emissions.

Continent	Percent
Asia:	53%
Africa:	18%
Europe:	11%
North America:	9%
Australia:	6%
South America;	4%

Source: EPA 2009f

In 2006, EPA estimated that 50-70 percent of current global anthropogenic atmospheric emissions came from fuel combustion, and much of it came from China, India, and other Asian countries (EPA 2006). Coal consumption in Asia is expected to grow significantly over the next 20 years (EPA 2006). This international source of mercury emissions may grow substantially if left unaddressed (EPA 2006).

Over the past decade, addressing environmental and human health mercury risks has been a focus for EPA (EPA 2006). Overall U.S. mercury air emissions have been reduced by 45 percent since 1990 (EPA 2006). EPA is most concerned with methyl mercury, a potent form of mercury and the form to which humans are primarily exposed (EPA 2006).

Atmospheric mercury can settle into water or onto land where it can be washed into the water. Certain microorganisms can transform mercury into methyl mercury, a highly toxic mercury compound that builds up in fish and shellfish when they feed. Methyl mercury is the only form of mercury that biomagnifies in the food web. Concentrations of methyl mercury in fish are generally on the order of a million times the methyl mercury concentration in the water. The primary pathway of human exposure to mercury is through eating fish containing methyl mercury (EPA 2006).

There are adverse health effects to humans and other animals that consume these fish and shellfish. Birds and mammals that eat fish may be more exposed to mercury more than other animals in water ecosystems (EPA 2008c). At high levels of exposure, methyl mercury's harmful effects may include death, reduced reproduction, slower growth and development, and abnormal behavior (EPA 2008c). Research has shown that most people's fish consumption does not cause a health concern, but high levels of methyl mercury in the bloodstream of unborn babies and young children may harm the developing nervous systems of those children (EPA 2006).

DOE's Office of Fossil Energy has been sponsoring studies on mercury emissions from coal-based power generators to identify effective and economical control options for the past decade USDOE 2006a). The Office of Fossil Energy manages the largest funded program in the U.S. for developing an understanding of mercury emissions and developing emission control technologies for the coal-

fired electric generating industry in the U.S. (USDOE 2006a). Research on advanced and improved mercury control technology is ongoing (USDOE 2006a).

In the U.S., coal-burning power plants are the largest human-caused source of mercury emissions being released into the air, accounting for about 40 percent of all domestic human-caused mercury emissions (EPA 2008c). However, these emissions contribute little to the global mercury pool. EPA estimated that mercury emissions from U.S. coal-fired power plants account for about 1 percent of the global total (EPA 2009f).

Coal production from the Wyoming PRB represented approximately 42 percent of the coal used for power generation in 2006, which would represent about 0.4 percent of the global anthropogenic mercury emissions. The South Gillette Area Mines produced about 22.7 percent of the coal produced in the Wyoming PRB in 2006, which would represent about 0.1 percent of the global mercury emissions. Under the No Action alternatives, mercury emissions attributable to burning coal produced by the South Gillette area mines would be extended at about current levels of up to approximately 16 years, while the mines recover their remaining estimated 1,564 million tons of currently leased coal reserves. Under the Proposed Actions or Alternatives 1 or 2, the South Gillette Area mines contribution to global mercury emissions would be extended from 2 to 10 additional years, depending on the tract and alternatives selected. Uncertainties about future regulatory requirements and the use of the coal mined from the South Gillette Area LBA tracts make it difficult to project the impacts of mercury emissions produced by burning SGAC coal.

Additionally, burning coal in electric utility boilers generates residual materials which are referred to as coal combustion residues. These residues include non-combustible materials left in the furnaces and ash that is carried up the smokestacks and collected by air pollution control technologies. As previously referenced, coal and coal combustion residues can contain a variety of compounds, metals, and other elements depending on the coal deposit and upon the site-specific characteristics of where the coal originated from. Coal-fired boilers are required to have control devices to reduce the amount of emissions that are released into the atmosphere (EPA 2007f). The use of air pollution control equipment at power plants has resulted in fewer emissions but has also increased the amount of solid residues.

In the past, coal combustion residues have generally been recycled or disposed of in landfills or surface impoundments. More recently, these residues have been disposed of in mines. There can potentially be risks of contamination of drinking water supplies and surface water bodies by coal combustion residues, particularly when they are disposed of in mines (National Academy of Science 2006, EPA 2002). The EPA is evaluating management options for solid wastes from coal combustion, including whether current management practices pose risks to human health or ecological receptors. A draft report, dated August 6, 2007, prepared for the EPA Office of Solid Waste, and entitled "Human and Ecological Risk Assessment of Coal Combustion Wastes", is available at

http://www.earthjustice.org/library; however, the report is labeled as a draft document which is not to be cited or quoted.

As discussed above, the South Gillette Area coal mines produced about 22.7 percent of the coal produced in the Wyoming PRB in 2006. Under the No Action alternatives, production of coal combustion residue attributable to burning coal from the South Gillette area mines would be extended at about current levels for up to approximately 16 years, while the mines recover their remaining estimated 1,564 million tons of currently leased coal reserves. Under the Proposed Action or Alternatives 1 or 2, coal combustion residue related to burning coal mined at the South Gillette area mines would be extended from 2 to 10 additional years, depending on the tract and alternatives selected. Uncertainties about future regulatory requirements and the use of the coal mined from the South Gillette Area LBA tracts make it difficult to project the impacts of disposing of coal combustion residues produced by burning SGAC coal.

Depending on the size, shape, and chemical composition, some coal combustion residues can be recycled and beneficially reused as components of building materials or as replacement to raw materials that would ordinarily need to be mined such as sand, gravel, or gypsum (EPA 2007f). Coal combustion products (CCPs) are the materials produced primarily from the combustion of coal in coal-fired power plants and can include the following materials: fly ash, bottom ash, boiler slag, and flue gas desulfurization material (EPA 2007f). Studies and research conducted or supported by the EPA, EPRI, other government agencies, and universities have indicated that the beneficial uses of coal combustion products have not been shown to present significant risks to human health or the environment (EPA 2008d).

Fly ash is a byproduct of burning finely ground coal in a boiler to produce electricity. Physically, fly ash is a fine, powdery material composed mostly of silica and nearly all particles are spherical in shape. Fly ash is a pozzolan—a siliceous material which, in the presence of water, will react with calcium hydroxide at ordinary temperatures to produce cement like compounds. Because of its spherical shape and pozzolanic properties, fly ash can be useful in cement and concrete applications (EPA 2007g).

Bottom Ash is agglomerated ash particles, formed in furnaces burning pulverized coal that are too large to be carried in the flue gases. Bottom ash is coarse with grain sizes spanning from fine sand to fine gravel. It can be used as a replacement for aggregate and is usually sufficiently well-graded in size to avoid the need for blending with other fine aggregates to meet gradation requirements (EPA 2007h).

Boiler slag is the molten bottom ash collected at the base of slag tap and cyclone type furnaces. Boiler slag particles are uniform in size, hard, and durable with a resistance to surface wear. The permanent black color of this material is desirable for asphalt applications and aids in the melting of snow (EPA 2007i).

Flue Gas Desulfurization (FGD) is the technology used for removing or reducing SO_2 emissions from the exhaust gas system of a coal-fired boiler (EPA 2007j). SO_2 is an acid gas and so the typical materials used to remove the SO_2 from the flue gases are alkaline. The reaction taking place in wet scrubbing uses a limestone slurry and produces calcium sulfate. When magnesium hydroxide is used as a scrubber, magnesium sulfate is produced. These materials can be used as embankment and road base material, wallboard manufacturing, and in place of gypsum for the production of cement. Currently, the largest single market for FGD material is in wallboard manufacturing (EPA 2007j).

Utilizing or recycling CCPs can generate significant environmental and economic benefits (EPA 2009g). CCPs can be used for raw feed for cement clinker, concrete, grout, flowable fill, structural fill, road base/sub-base, soil modification, mineral filler, snow and ice traction control, blasting grit and abrasives, roofing granules, mining applications, wallboard, waste stabilization/solidification, and soil amendment. Using CCPs can reduce energy consumption and greenhouse gas emissions and can help reduce the need for landfill space. Economic benefits include reduced costs associated with managing coal ash and slag disposal, potential revenue from the sale of CCPs, and savings from using CCPs in place of other more costly raw materials (EPA 2009g).

CCPs offer product-performance benefits as well. Boiler slag is a sought-after replacement for sand in blasting grit because it is free of silica and eliminates the potential health risk of silicosis (EPA 2007i). High coal ash content concrete is used for building long-lived pavements designed to last 50 years—twice the lifetime of conventional pavements (EPA 2003b). Coal fly ash can create superior products because of its self-cementing properties (EPA 2007g). Using coal fly ash in concrete can also produce stronger and longer-lasting buildings (EPA 2007g). This not only reduces the costs of maintaining buildings, but provides the additional environmental benefit of reducing the need for new concrete to repair or replace aging buildings. This translates to a significant reduction in future energy consumption and GHG emissions (EPA 2007g).

In 2005, demand had become so strong for coal ash that some power plants were selling all the ash they produced (EPA 2005b). EPA estimated that through the utilization of 15 million tons of coal fly ash, the U.S. reduced their greenhouse gas emissions equivalent to the annual emissions of nearly 2.5 million passenger vehicles (EPA 2008e).

Because of the many potential uses of CCPs, EPA has sponsored the Coal Combustion Products Partnership (C^2P^2) program to further the beneficial use of these coal combustion by-products (EPA 2003b). With more than 170 private and public partners (EPA 2008e), the C^2P^2 Program is a cooperative effort between EPA and various organizations to help promote the beneficial use of CCPs and the environmental benefits which can result from the proper use of these potentially recyclable materials (EPA 2003b). The C^2P^2 program will help meet the national waste reduction goals of the Resource Conservation

Challenge—an EPA effort to find flexible yet more protective ways to conserve valuable natural resources through waste reduction, energy recovery, and recycling (EPA 2008b).

In 2007, the U.S. used approximately 43 percent of its coal combustion products (EPA 2008e). The C^2P^2 program aims to reduce adverse effects on air and land by increasing the use of coal combustion products to 50 percent in 2011 from 32 percent in 2001 (EPA 2008e). The program also plans to increase the use of CCPs as a supplementary cementitious material in concrete by 50 percent, from 12.4 million tons in 2001 to 18.6 million tons in 2011; this would decrease GHG emissions from avoided cement manufacturing by approximately 5 million tons (EPA 2009h).

5.0 CONSULTATION AND COORDINATION

In addition to this environmental impact statement (EIS)[1], other factors and consultations are considered and play a major role in determining the decision on this proposed lease application. These include the following.

Regional Coal Team Consultation

The four coal lease applications included in this EIS were reviewed and discussed at Powder River Regional Coal Team (PRRCT) public meetings held on April 24, 2005, in Gillette, Wyoming (Belle Ayr North Tract), on April 19, 2006 in Casper, Wyoming (Caballo West and West Coal Creek Tracts), and on January 18, 2007, in Gillette, Wyoming (Maysdorf II Tract). Each of the applicants presented information about their existing mine and pending lease application to the PRRCT at those meetings. Voting and nonvoting members of the PRRCT include the governors of Wyoming and Montana, the Northern Cheyenne Tribe, the Crow Tribal Council, the U.S. Department of Agriculture - Forest Service (USDA-FS), Office of Surface Mining Reclamation and Enforcement (OSM), U.S. Fish and Wildlife Service (USFWS), National Park Service (NPS), and U.S. Geological Survey (USGS). The PRRCT determined that the lands in the four applications met the qualifications for processing as production maintenance tracts. The PRRCT recommended that the Bureau of Land Management (BLM) continue to process all four lease applications.

Governor's Consultation

The Bureau of Land Management (BLM) Wyoming State Director notified the Governor of Wyoming on March 14, 2007, that Foundation Coal West (FCW) had filed a lease application with BLM for the Belle Ayr North Lease by Application (LBA) Tract. The BLM Wyoming State Director notified the Governor of Wyoming on April 27, 2006, that Caballo Coal Company (CCC) had filed a lease application with BLM for the Caballo West LBA tract. The Governor was notified on September 18, 2006 that Ark Land Company (ALC) had filed a lease application for the West Coal Creek LBA tract and that Cordero Mining Company (CMC) had filed a lease application for the Maysdorf II LBA tract.

Public Notice

A notice announcing the receipt of the Belle Ayr North coal lease application was published in the *Federal Register* on March 8, 2005; a BLM news release announcing the receipt of the Caballo West and West Coal Creek coal lease applications was issued on March 27, 2006; and a notice announcing the receipt of the Maysdorf II coal lease application was published in the *Federal Register* on December 12, 2006. These notices also announced the date, time, and place of the PRRCT meetings to be held to discuss these lease applications. BLM

[1] Refer to page xxii for a list of abbreviations and acronyms used in this document.

published a Notice of Intent to Prepare an Environmental Impact Statement and Notice of Scoping in the *Federal Register* on March 29, 2007 and in the Gillette News-Record on April 4, 2007. The publications served as public notice that the four coal lease applications had been received, announced the time and location of a public scoping meeting, and requested public comment on all four of the applications.

Parties on the distribution list were sent letters announcing the time and location of a public scoping meeting in April 11, 2007 in Gillette, Wyoming. At the public meeting, the applicants orally presented information about their mines and their need for the coal. The presentations were followed by a question and answer period, during which no oral comments were made. The scoping period extended from March 29 through June 10, 2007, during which time BLM received written, e-mailed, and telephoned comments from six entities.

The EPA published a notice announcing the availability of the draft EIS in the *Federal Register* on October 24, 2008. BLM published a Notice of Availability/Notice of Public Hearing in the *Federal Register* on October 17, 2008. The 60-day comment period on the draft EIS ended on December 24, 2008. A public hearing was held on November 19, 2008 at 7:00 pm at the Campbell County George Amos Memorial Building. One individual presented statements on the draft EIS during the hearing and written comments were received from 18 individuals, agencies, or organizations during the comment period. A summary of the statements that were presented at the formal public hearing and the written comments, with agency responses, are included as appendix I of this FEIS.

Parties on the distribution list have been sent copies of the completed FEIS, and the EPA and BLM have published Notices of Availability for the FEIS. After a 30-day availability period, BLM will make separate decisions to hold or not to hold a competitive lease sale for the federal coal in each of these LBA tracts and a Record of Decision (ROD) for each of the tracts will be signed. Copies of each ROD will be mailed to parties on the mailing list and others who commented on this LBA during the National Environmental Policy Act (NEPA) process. There will be a 30-day appeal period after each ROD is signed before the ROD is implemented.

Department of Justice Consultation

After each competitive coal lease sale, but prior to issuance of a lease, BLM will solicit the opinion of the Department of Justice on whether the planned lease issuance creates a situation inconsistent with federal anti-trust laws. The Department of Justice is allowed 30 days to make this determination. If the Department of Justice has not responded in writing within the 30 days, BLM can proceed with issuance of the lease.

Other Consultations

Other federal, state, local, and Native American governmental agencies that have been consulted in preparation of this EIS or will be consulted prior to making a decision to hold or not to hold a federal coal lease sale are listed in the following tables.

Contributors, Reviewers, and Preparers

This EIS was prepared by WWC Engineering, a third-party contractor, under the direction of the BLM. Representatives from cooperating agencies reviewed and contributed to the EIS. Tables 5-1 and 5-2 provide listings of the BLM, cooperating agency, and third-party consultant personnel who prepared and reviewed this EIS.

Distribution List

This EIS was distributed to Congressional offices, federal agencies, state governments, local governments, industry representatives, interest groups, and individuals for their review and comment (Table 5-3).

Table 5-1. List of Contributors and Reviewers.

Name	Project Responsibility
	BLM High Plains District Office
Mike Karbs	Project Supervisor
Teresa Johnson	SGAC EIS Project Manager, Environmental Protection Specialist
Sarah Bucklin	Wildlife, T&E Species
Ginger Vickers	Legal Assistant, Distribution List
Mike Brogan	Water Resources
Patricia Karbs	Editor
	BLM Wyoming State Office
Bob Janssen	Coal Program Coordination
Linda Slone	NEPA Coordination
Janet Kurman	NEPA Coordination
Mavis Love	Land Adjudication
Larry Jensen	Socioeconomics
Steve Hageman	Minerals Appraiser
Bill Hill	Resources
Susan Caplan	Air Quality and Climate
John Zachariassen	Air Quality and Climate
Rick Schuler	Water Resources
Julie Weaver	Land Adjudication
Sheri Morris	Printing Coordination
	BLM Wyoming Reservoir Management Group
Dwain McGarry	CBNG Geology
Karl Osvald	CBNG Geology
Lee Almasy	CBNG Reservoir Engineering
Dave Chase	Mineral Resources
	BLM Buffalo Field Office
Tom Bills	EIS Liaison
B.J. Earle	Cultural Resources
Clint Crago	Cultural Resources, Paleontology
Buck Damone	Cultural Resources
Kay Medders	Rangeland Resources
Jerry Queen	Geology, Mineral Resources, Mining Claims
Larry Gerard	Wildlife
Chris Durham	Wildlife, T&E Species, BLM Sensitive Species
	BLM National Science and Technology Center (Powder River Basin Coal Review)
Craig Nicholls	Air Quality and Climate
Paul Summers	Water Resources
	Office of Surface Mining Reclamation and Enforcement Western Regional Coordinating Center
Heather Erickson	EIS Project Coordinator
Foster Kirby	Archaeologist, EIS Cooperating Agency Representative
	Wyoming Department of Transportation
Larry Konetzki	EIS Cooperating Agency Representative
	University of Wyoming
Bonnie Heidel	Wyoming Natural Diversity Database Botanist
Ron Hartman	Rocky Mountain Herbarium Curator
B. Ernie Nelson	Rocky Mountain Herbarium Manager

Table 5-1. List of Contributors and Reviewers (Continued).

Name	Project Responsibility
Wyoming Department of Environmental Quality (WDEQ) Office of Outreach Services	
Dan Clark	Ombudsman, EIS Liaison
WDEQ Land Quality Division	
Don McKenzie	Administrator
Kathy Muller Ogle	CHIA Program Supervisor
Mark Rogaczewski	District Three Supervisor
Doug Emme	Blasting Program Principal
WDEQ Air Quality Division	
Kelly Bott	Engineer/EIS Cooperating Agency Division Representative
WDEQ Water Quality Division	
Mark Conrad	Water Resources
Wyoming Game and Fish Department	
John Emmerich	Deputy Director – External Programs
Wyoming State Planning Office	
Tom Blickensderfer	Policy Analysis
Steve Furtney	Coal Issues Coordination/Cooperating Agency Representative
ENSR International (Powder River Basin Coal Review)	
Valerie Randall	Project Manager
Dolora Koontz	Assistant Project Manager and Task 2 Manager (Existing Development and Reasonably Foreseeable Development)
Eldon Strid, Matt Reilly	Existing and Projected Coal Development and Coal Transportation Scenarios
Doree Dufresne	Database Development
Bruce MacDonald, PhD	Air Quality
Robert Berry, PhD	Water Resources
James Rumbaugh	Ground Water Modeling
Brad Anderson	Surface Water
Ron Dutton, George Blankenship	Socioeconomics
Bernhard Strom	Land Use, Transportation, and Utilities
William Berg	Topography, Geology, and Minerals
James Burrell, James Nyenhuis	Soils and Alluvial Valley Floors
Jon Alstad	Vegetation, Wetlands, and Grazing
Charles Johnson	Wildlife
Rollin Daggett	Fisheries
Kim Munson	Native American Concerns, and Paleontological Resources
National Oceanic and Atmospheric Association	
Pieter Tans	Earth System Research Laboratory Global Monitoring Division Carbon Cycle and Greenhouse Gases Senior Scientist

Table 5-2. List of Preparers.

Name	Education/Experience	Responsibility
	BLM Casper Field Office	
Mike Karbs	33 years professional experience, M.S., B.S. Mineral Engineer, Public Policy	Project Supervisor
Teresa Johnson	M.S. course work in Ecosystem Management, B.S. Earth Systems Ecology, Native American Cultural Emphasis Phase 3 years professional NEPA experience	EIS Project Leader/Editor
Patricia Karbs	27 years professional BLM editing experience	EIS Project Editor
	WWC Engineering **Third-Party Contractor**	
John Berry	B.S. Wildlife Biology, 32 years professional experience	Project Management Report Preparation
Ken Collier	B.S. Geology, 32 years professional experience (Licensed Wyoming Geologist)	Report Preparation
Heidi Robinson	18 years professional experience	Document Production
Mal McGill	11 years professional experience	CADD

Subcontractors for FCW	Responsibility
TRC Mariah Associates, Inc.	Paleontology Survey
McVehil-Monnett Associates, Inc.	Air Quality Assessment
WWC Engineering	Water Resources Study Preliminary AVF Assessment Wetlands Assessment
James Nyenhuis	Soil Survey
ESCO Associates, Inc.	Vegetation Survey T&E Vegetation Survey
Thunderbird-Jones & Stokes	Wildlife Survey T&E Animal Survey
Environmental Solutions, Inc.	Land Use Assessment
TRC Mariah Associates, Inc.	Cultural Resource Survey
Planera, Inc./WWC Engineering	Socioeconomic Study

Subcontractors for ALC/TBCC	Responsibility
SWCA Environmental Consultants	Paleontology Survey
Knight Technologies, Inc	Water Resources Study
BKS Environmental Associates, Inc.	Wetlands Survey
BKS Environmental Associates, Inc.	Soil Survey
BKS Environmental Associates, Inc.	Vegetation Survey T&E Vegetation Survey
Thunderbird-Jones & Stokes	Wildlife Survey T&E Animal Survey
ACR Consultants, Inc.	Cultural Resource Survey
WWC Engineering	Socioeconomic Study

Table 5-2. List of Preparers (Continued).

Subcontractors for CCC	Responsibility
GCM Services, Inc.	Paleontology Survey
BKS Environmental Associates, Inc.	Wetlands Survey
BKS Environmental Associates, Inc.	Soil Survey
BKS Environmental Associates, Inc.	Vegetation Survey T&E Vegetation Survey
Thunderbird-Jones & Stokes	Wildlife Survey T&E Animal Survey
GCM Services, Inc.	Cultural Resource Survey
WWC Engineering	Socioeconomic Study

Subcontractors for CMC	Responsibility
Aqua Terra Consultants	Geology
TRC Mariah Associates, Inc.	Paleontology Survey
Aqua Terra Consultants	Water Resources Study
ESCO Associates, Inc.	Wetlands Survey
James Nyenhuis	Soil Survey
ESCO Associates, Inc.	Vegetation Survey T&E Vegetation Survey
Intermountain Resources	Wildlife Survey T&E Animal Survey
TRC Mariah Associates, Inc.	Cultural Resource Survey
WWC Engineering	Socioeconomic Study

Table 5-3. BLM Distribution List for the South Gillette Area Final EIS.

Federal and State Officials
Governor of Wyoming, Dave Freudenthal
Governor of Montana, Brian Schweitzer
US Congresswoman Cynthia M. Lummis
US Senator John Barrasso
US Senator Mike Enzi
Representative Dave Edwards
Representative Erin Mercer
Representative Sue Wallis
Representative Thomas Lubnau
Representative Timothy Hallinan
Senator Jim Anderson
Senator John Hines
Senator Michael Von Flatern

Federal Agencies
BLM Library, Denver CO
BLM, Buffalo, WY
BLM, Casper, WY
BLM, Cheyenne, WY
BLM, Miles City, MT
BLM, Montana State Office, Billings, MT
BLM, Washington, DC
Bureau of Indian Affairs, Washington, DC
Department of Energy, Casper, WY
Department of Energy, Washington, DC
Department of Interior, Denver, CO
Devils Tower National Monument
HQ-USA/CEVP
Medicine Bow National Forest, Laramie, WY
MMS, Denver, CO
MMS, Helena, MT
MMS, Herndon, VA
National Park Service, Washington, DC
NPS - Air Resources, Denver, CO
NPS – Washington, DC
NRCS, Douglas, WY
OEPC, Denver, CO
OSM, Casper, WY
OSM, Denver, CO
OSM, Washington, DC
OSM/WR, Denver, CO
Rocky Mountain Region Solicitor
US Army Corps of Engineers, Cheyenne, WY
US Department of the Interior Natural Resources Library
US EPA Region VIII, Denver, CO
US EPA, Washington, DC
US Fish & Wildlife Service, Arlington, VA
US Fish & Wildlife Service, Cheyenne, WY
US Geological Survey, Cheyenne, WY
US Geological Survey, Denver, CO
US Geological Survey, Reston, VA
US Government Printing Office, Washington, DC
USDA Forest Service, Golden, CO
USDA-FS Douglas Ranger District, Douglas, WY
USDA-FS Rocky Mountain Region, Golden, CO
USGS Water Resources Division, Cheyenne, WY

Wyoming State Agencies
Mineral Management Bureau
Office of State Lands and Investments
Office of the State Treasurer
State of Wyoming
State of Wyoming Commissioner of Public Lands
State of Wyoming Office of State Lands & Investments
WDEQ - Water Quality Division, Cheyenne, WY
WDEQ-Air, Cheyenne, WY
WDEQ-Land Quality Division, Cheyenne, WY
WDEQ-Land Quality Division, Sheridan, WY
WY Department of Education
WDEQ State Office
WY Department of Employment Research & Planning
WY Parks & Cultural Resource Dept.
WY State Geological Survey
Wyoming Department of Agriculture
Wyoming Department of Transportation
Wyoming DEQ/ISD, Cheyenne, WY
Wyoming Farm Loan Board
Wyoming Game and Fish, Cheyenne, WY
Wyoming Game and Fish, Lander, WY
Wyoming Game and Fish, Sheridan, WY
Wyoming Oil and Gas Commission
Wyoming Sate Historic Preservation Office
Wyoming State Engineer's Office
Wyoming State Geological Survey
Wyoming State Planning Office
Wyoming Water Development Comm

Local Government and Agencies
Big Horn County Commission
Campbell County Board of Commissioners
Campbell County Cemetery District
Campbell county Conservation District
Campbell County Engineer
Campbell County Roads and Bridges
Campbell County School District
Campbell County Economic Develp. Corp.
CANDO
City of Douglas
City of Gillette
Converse County School District
Converse County Commission
Converse County Joint Powers Board

Table 5-3. BLM Distribution List for the South Gillette Area Final EIS (Continued).

Converse County Special Projects
Gillette Department of Community Development
Rosebud County Commission
Town of Wright
Weston County Board of Commissioners

Tribal Organizations and Individuals
Apache Tribe of Oklahoma
Arapahoe Business Council
Cheyenne River Sioux Tribal Council
Cheyenne River Sioux Tribe, THPO
Cheyenne-Arapaho Tribes of Oklahoma
Comanche nation
Comanche Nation Business committee
Comanche nation NAGPRA Coordinator
Crow Creek Council
Crow Creek Sioux Tribal Council Chair
Crow Creek Sioux Tribe
Crow Tribe THPO
Eastern Shoshone Tribe THPO
Flandreau Santee Sioux Tribe
Flandreau Santee Sioux Tribe THPO
Kiowa Business Committee
Kiowa Business Committee Environmental Director
Lower Brule Sioux Tribal Council
Northern Arapaho Tribe THPO
Northern Arapahoe Business Council
Northern Cheyenne Cultural Commission
Northern Cheyenne Tribal Council
Oglala Sioux Tribal Council
Oglala Sioux Tribal THPO
Oglala Sioux Tribe
Rosebud Sioux THPO
Rosebud Sioux Tribal Council
Rosebud Sioux Tribe Cultural Resource Coordinator
Santee Sioux Tribal Council
Shoshone Business Council
Standing Rock Sioux Tribal Council
Standing Rock Sioux Tribe
Standing Rock Sioux Tribe THPO

Organizations
Advisory Council on Historic Preservation
BioDiversity Conservation Alliance
Center for Biological Diversity
Defenders of Wildlife
Federation for North American Wild Sheep
Medicine Wheel Coalition
National Mining Association
National Wildlife Federation
Natural Resources Defense Council
Powder River Basin Resource Council
Resolute Wyoming
Sierra Club
Theodore Roosevelt Conservation Partnership
Thunder Basin Coalition
Trout Unlimited
WildEarth Guardians
WY Business Council/NE Region
WY O & G Conservation Commission
WY Association of Professional Archeologists
Wyoming Bankers Association
Wyoming Business Alliance
Wyoming Mining Association
Wyoming Outdoor Council
Wyoming Public Service Comm
Wyoming Stock Growers Association
Wyoming Wildlife Federation, Cheyenne, WY
Wyoming Wildlife Federation, Lander, WY
Wyoming Wool Growers Association

Companies / Businesses
ABO Petroleum Corp
Ag Andikopoulos Resources
All American Equipment
American Colloid Company
Antelope Coal Company
Ark Land Company
Ballard petroleum Holdings LLC
Bank of America, NA
Barrett Resources Corporation
Belle Fourche Pipeline Company
BHCH Mineral, Ltd
Bill Barrett Corporation
Bjork Lindley Little PC
BKS Environmental
Blackbeard Oil & Gas, LLC
BNSF Railway Company
Bowden Energy Corporation
Bridgeview Coal co
Buckskin Mine
Burns & McDonnell
Canaan Resources, LLC
Carbon Recovery Technology
Cavalier petro Corp.
CH Snyder Company
Chaco Energy Company
Chess Oil & Gas LLC
Chevron midcontinent LP
Citation Oil & Gas Corporation
Club O & G Ltd.
Coal Creek Mine
CONSOL Inc Expl & Land Dept

Table 5-3. BLM Distribution List for the South Gillette Area Final EIS (Continued).

Cordero Mining Company
Cordero Rojo Mine
Cramer Oil Company DAC Interests, LLC
Cucker, Montgomery, Aronstein & Bess, PC
Dee Bentley, Inc.
Double T Resources, LLC
Dry Fork Coal Company
Ducker Montgomery et al.
Duncan inc.
Duncan Oil Inc.
Dunlap Family LLC
Dunway Investment Company
Economic Analysis division
EDE Consultants
Electra Investment
Ellbogen Property Management LTD, fbo
  John Ellbogen Foundation
Ellbogen Property Management, Ltd.
ENSR
Environmental Solutions Inc
Exxon Mobile Oil Corporation
First National Bank of Gillette
Five Star Energy, LLC
Forest Oil Corp
Foundation Coal West, Inc
Foundation Coal West, Inc PKA
Fredericksburg Royalty, Ltd
Gene F Lang & Company
GH Exploration, Inc.
Great Points Energy
Hardin & Associates
Headington Minerals Inc.
Hulett National Bank
Inexco Oil Company
ING (US) Capital LLC
Intermountain Resources
Interwest Mining Company
Issacs Family Limited Liability Partnership
J. Walter Duncan, Jr., Inc.
Jacobs Ranch Coal Company
JIREH Exploration and Consulting LLC
John E. Jacobs Family Company LLC
JWD III Inc.
KAB Acquisition LP II
Kaiser-Francis Oil Company
Kenneth R. Paulsen Consultants
Kerr McGee Oil & Gas Onshore LP
Key Production Co. Inc.
Key Production Company inc.
Kiewit Mining Company
Kiewit Mining Group Inc
Kiewit Mining Properties Inc.
Kinder Morgan Operating LPA
KM Upstream, LLC
KN Gas Gathering Inc.
Koch Exploration Company LLC
Lance Oil & Gas Company Inc.
Landmark Oil & Gas, LLC
Lario Oil & Gas Company
Lasmo Oil & Gas Inc.
LE Peabody & Associates
Lindys Living Trust
Lorie Amie Hayden Revocable Trust
Louisiana Land & Exploration Co.
M & K Oil Company, Inc
Marquiss Minerals, Inc.
Marquiss Minerals, Inc. Little Buffalo Ranch
Marston & Marston
Maxim Drilling & Exploration
McCulloch Interstate Gas Corporation
McGraw-Hill
McVehil-Monnett Assoc Inc.
Meagher Oil and Gas Properties Inc.
MEG Wyoming Gas Service, LLC / Merit
  Management Partners I, LP
Meineadair Consultants
Merit Energy Partners III< LP
Mine Engineers Inc.
Mining Associates of Wyoming
Moreenergy Exploration Company
MYCO Industries, Inc
Nance Petroleum Corp.
Nerco Coal Company
NM Doelger Consulting, LLC
Norwest Corporation
P & M Coal Mining CO
P & M Petroleum management LLC
Paseo Resources LLC
Paul Charles Keidel c/o Keidel Family LP
Paul Rourke Living Trust et al
Peabody Energy
Peabody Natural Gas LLC
Petro Atlas Corporation
Petrogulf II Ltd.
Petroleum Association of Wyoming
Paul Charles Keidel c/o Keidel Family LP
Paul Rourke Living Trust et al
Peabody Energy
Peabody Natural Gas LLC
Petro Atlas Corporation
Petrogulf II Ltd.
Petroleum Association of Wyoming
Powder River Coal Company
Powder River Energy Corporation
Powder River Oil Company
Primary Natural Resources Inc.
Providence Energy Corporation
Quantum energy
Quiogue Woods Building Co. LLC

Table 5-3. BLM Distribution List for the South Gillette Area Final EIS (Continued).

QWEST Communications International, Inc.
Raymond T. Duncan Oil Properties, Ltd
RIM offshore, Inc.
RIM-CBM LLC
Rio Tinto energy America
Riverside Technology Inc.
RMG I LLC
Royal Properties Inc.
RSR Energy, LLP
Ruth R Ellbogen Limited partnership
San Juan Coal Company
Sapphire Bay, LLC
States, Ltd
T7 Resources LLC
TC Minerals LLC
Tetra Tech EC, Inc.
The Ogle Corporation
The Termo Company
Thunder Basin Coal Company, LLC
Thunder bird-Jones & Stokes
TRC Environmental
Union Pacific Railroad
US Bank National Association
US West Communications
UV Industries, Inc / Mueller Industries, Inc.
Veracruz Ventures, LLC
Wachovia Bank, National Association
Walter Duncan Oil
Warren Broyles & Co.
Well Fargo Bank, NA
Wellstar Corporation
Western Energy Company
Western Fuels Association
Whiting Oil & Gas Corp
Williams production RMT Co.
WWC Engineering
Yates Drilling Co.
Yates petroleum Corp et al

Press

Associated Press
Casper Star Tribune
Douglas Budget
Gillette News-Record
Platts
Rocky Mountain Oil Journal
Wyoming-Tribune Eagle

Educational Institutions

CSU Library
Northwestern University
NWU Policy Research Institute
URS Greiner Woodward Clyde Library
US Department of the Interior Natural Resources library
UW Libraries

Individuals

Atkins, Mary
Baalman, Lynne & Mark
Barbero, Ralph
Belden, Scott
Benson, Scott
Bertalot, Kenneth & Angela
Bierman, Sheldon
Brandner-Daveis, Marjorie
Brown, Maurice
Carter, Chrystal
Christensen, Nita
Clabaugh, Bonnie
Clabaugh, Kyle
Cole-Ballantyne, Betty
Coleman, Mark
Collins, Kristina
Conkey, Bonnie
Couch, Marion
Couch, Tom
Cowan, Minnie
Craft, Laic
Cupery, Karla
Deaver, Michael & Pam
Diefenderfer, Michael
Doyet, Barbre
Duncan, Nicholas
Duncan, Walter
Dunlap, Helen
Duvall, Kenneth & Norma
Duvall, Norma
Edwards, Dennis
Edwards, Orin
Edwards, Teddy & Renae
Eichenberger, Lucy
Ellexson, Vera
Farrell, Jane
Farrell, Joyce
Farrell, Margaret
Farrell, Martin
Farrell, Thomas
Fisk, Dennis
Fisk, Sheila
Fluharty, Kristi
Freeburn, Jolene
Fuller, R.
Geis, Kahla
Ghanavatzad, Khanon
Glustrom, Leslie
Graham, Terrel
Graham-Bowe, Helen

Table 5-3. BLM Distribution List for the South Gillette Area Final EIS (Continued).

Gray, Jess & Hellon Carol
Greub, Twyla
Guida, Betty
Gulley, Beverly
Haight, Bruce & Jilaine
Haight, Leslie & Sandra
Hall
Harden III, James
Harris, Tami
Hayden, Dick
Hays, Joseph
Heisner, Bill
Hewit, Betty
Hill, Bruce
Hoecher, Velda
Hogan, Debbie
Hudson II, William
Hudson Jr., Edward
Hunson, Bob
Johnson et al, Bob & Chrystal
Johnson, Steven & Debora
Jourkeet et al, James
Kamon, Ken
Keidel, Craig
King, Dorcas
King, James
King, John
Kirkwood, Robert
Kirkwood, Steven
Knapp, Everett & Waruny
Knotts, Marshal
Koch, Kathy
Kundrick, Kenneth
Larson, Patsy
Lauchnor, Emily
Lawson, Robert & Beverly
Lee, Helen
Lee, Marcea
Lippard, Gary
Loflin, Linda
McAfee
Miller, Gary & Patty
Miller, Glenn & Susan
Mills, Edith & Dale
Mills, Kahla
Morgan Jr., Norvvid
Morgan, Alice
Morgan, Rock
Morris, Julie
Nelson, Toni
Nely, Regina
Nichols, Jeremy
Nyenhuis, Jim
O'Brien, Bradley & Cheryl
Oedekoven, John
O'Reilly, Jane
Osborn, Dale
Papp, Alex
Plemmons, Daniel
Plemmons, Jason
Plemmons, John
Plemmons, Leonard
Plemmons, Roy
Prewitt, Jason & Megan
Prucelli, Dean
Raitt, Keith
Ratcliff, Sam
Reyonlds, Jay
Roudebush, Betty (Green)
Saulcy, Bill
Schicktanz, William & Dorothy
Schott, Kim
Smith, Nancy
Stock, Christopher & Barbara
Storey, Bill
Terry, Kent & Charlotte
Thompson
Thrush, Earl
Thrush, Jakob
Thrush, Richard
Thrush, Valdo
Treselle, Rodger
Ukeiley, Robert
Ultican-Spear, Lois
Wagensen-Coltrane, Mary
Wagensen-Fisher, Leslie
Wagner, David & Jean
Walter, Michael
Ward, Linda
Williams, John
Williams, Keith
Williams, Monica
Wilmot, Roger
Wing, Everett & Virginia
Winland, Mark
Winninger, Lora

Trusts

AG Hoadley Memorial Trust
Aline Mankin, Trustee
Alta Vivian-Hayden Trust
Barbara Evans Family Trust
Bessie Mae Trust
Boyd Family Mineral Trust
Delmar Hudson Lewis Living Trust
DJR Trust
Douglas B. Bickerstaff Revocable Trust
Doyle & Lora Hayden, Trust
Doyle G. Hayden Revocable Trust

Table 5-3. BLM Distribution List for the South Gillette Area Final EIS (Continued).

First Interstate Bank, Trustee
Frank Ford, Trustee
Gary Hayden, Trust
Ira Douglas & Pauline B. Wilson Family Revocable Trust
John Jacobs Revocable Trust
Kathleen Mae Glade Trust
Labin Garret, Trust
Larry & Katherin Dunlap Family Trust
Linda Rourke, Rev. Living Trust
Lindys Living Trust
Lorie Amie Hayden Revocable Trust
Lorraine Broyles Family Trust
Louisiana Land & Exploration Co.
M & K Oil Company, Inc
Marquiss Minerals, Inc.
Marquiss Minerals, Inc. Little Buffalo Ranch
Maxim Drilling & Exploration
McCulloch Interstate Gas Corp.
Nina Mae Evans Partnership Richard Evans, Trustee
North Trust Company, co-trustee Robert Mcllvain Jr.
Oswald Family Trust, Louis Oswald, Trustee
Paul Rourke Living Trust et al
PDI Trust
Robert & John Davis Family Revocable Trust
Robert E & Joan B Davis Revocable Trust
Separate Property Trust
Tess Garret, Trust
Thomas Dorough Family Trust
Viola Wilmot, Trust

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7.0 GLOSSARY

aboriginal - Related to early or primitive cultures in a region. Being the first or earliest known of its kind in a specific region.

ad valorem tax - A tax paid as a percentage of the assessed value of property.

adverse impact - An apparent direct or indirect detrimental effect.

aliquot - An exact portion.

alkalinity - The degree to which the pH of a substance is greater than 7.

alluvial deposit - Deposits of clay, silt, sand, gravel, and/or other materials carried by moving surface water, such as streams, and deposited at points of weak water flow; alluvium.

alluvial valley floor (AVF) - An area of unconsolidated stream-laid deposits holding streams with water availability sufficient for subirrigation or flood irrigation agricultural activities (see 30 CFR 701.5).

alluvium - Sorted or semi-sorted sediment consisting of clay, silt, sand, gravel, or other unconsolidated rock material deposited in comparatively recent geologic time by a stream or other body of running water in the bed of that stream or on its flood plain or delta.

alternative - In terms of the National Environmental Policy Act, one of several substitute or alternate proposals that a federal agency is considering in an environmental analysis.

ambient - Surrounding conditions (or environment) in a given place and time.

annual precipitation - The quantity of water that falls yearly in the form of rain, hail, sleet, and snow.

anthropogenic - A direct result of human activities or are the result of natural processes that have been affected by human activities (IPCC/UNEP/OECD/IEA 1997).

approximate original contour - Post-mining surface configuration achieved by backfilling and grading of mined-out areas so that the reclaimed land surface resembles the general surface configuration of the land prior to mining (see 30 CFR 701.5).

aquatic - Living or growing in or on the water.

aquifer - A layer of permeable rock, sand, or gravel that stores and transmits water in sufficient quantities for a specific use. In hydrology, a rock layer or

sequence that contains water and releases it in appreciable amounts. The rocks contain water-filled pores that, when connected, allow water to flow through their matrix. A confined aquifer is overlain by a rock layer that does not transmit water in any appreciable amount or that is impermeable. There probably are few truly confined aquifers. In an unconfined aquifer the upper surface (water table) is open to the atmosphere through permeable overlying material. An aquifer also may be called a water-bearing stratum, lens, or zone.

aquitard - A confining bed that retards but does not totally prevent the flow of water to or from an adjacent aquifer; a leaky confining bed.

area source – A plant site that does not emit any single HAP (Hazardous Air Pollutants) at a rate of 10 tons or greater per year, or any combination of HAPs at a rate of 25 tons or greater per year.

ash - The residual non-combustible matter in coal that comes from included silt, clay, silica, or other substances. The lower the ash content, the better the quality of the coal.

avian - Of, relating to, or derived from birds.

backfill - The operation of refilling an excavation. Also, the material placed in an excavation when it is refilled.

baseline - Conditions, including trends, existing in the human environment before a proposed action is begun; a benchmark state from which the environmental consequences of an action are forecast; the no-action alternative.

beneficial impact - An apparent direct or indirect advantageous effect.

bentonite – An absorptive and colloidal clay used especially as a sealing agent or suspending agent formed by the decomposition of volcanic ash which has the ability to absorb large amounts of water and to expand to several times its normal volume; used in adhesives, cements and ceramic fillers.

bonus - That value in excess of the rentals and royalties that is paid to the United States as part of the consideration for receiving a lease for publicly owned minerals [see 43 CFR 3400.0-5(c)].

buffer zone - An area between two different land uses that is intended to resist, absorb, or otherwise preclude development or intrusion between the two use areas.

carbon dioxide equivalent (CO_2e) - Measures for describing how much global warming a given type and amount of greenhouse gas may cause, using the functionally equivalent amount or concentration of carbon dioxide as the reference. CO_2e is expressed as parts per million by volume.

carbon sink - is a natural or manmade reservoir that accumulates and stores some carbon-containing chemical compound for an indefinite period.

climate change - A change in long-term weather patterns, i.e. warmer or colder temperatures or an increase or decrease in annual amounts of rainfall or snowfall.

clinker (scoria) - Baked and fused rock resulting from in-place burning of coal deposits.

coal bed natural gas (CBNG) - Natural gas (methane) that is generated during the coal-forming process.

colluvium - Rock fragments, sand, or soil material that accumulates at the base of slopes; slope wash.

confluence - The point at which two or more streams meet.

contiguous - Lands or legal subdivisions having a common boundary, lands having only a common corner are not contiguous.

cooperating agency - An agency which has jurisdiction by law in an action being analyzed in an environmental document and who is requested to participate in the NEPA process by the agency that is responsible for preparing the environmental document [see 40 CFR 1501.6 and 1508.5].

cultural resources - The remains of human activity, occupation, or endeavor reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, architecture, and natural features that reveal the nature of historic and prehistoric human events. These resources consist of (1) physical remains, (2) areas where significant human events occurred, and (3) the environment immediately surrounding the resource.

cumulative impact - The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

decibel - A unit of sound measurement. In general, a sound doubles in loudness for every increase of 10 decibels.

deciview (dv) - A general measure of view impairment (13 deciview equals a view of approximately 60 miles) caused by pollution. A 10 percent change in extinction corresponds to 1.0 dv.

dip - The angle at which a rock layer is inclined from the horizontal.

direct (or primary) impact - An impact caused by an action that occurs at the same time and place as the action (see 40 CFR 1508.8).

discharge - Any of the ways that ground water comes out of the surface, including through springs, creeks, or being pumped from a well.

dragline - A type of excavating crane that casts a rope- or cable-hung bucket a considerable distance, collects the dug material by pulling the bucket toward itself on the ground with a second rope or cable, elevates the bucket, and dumps the material on a backfill bank or pile.

eolian deposit - Sediment carried, formed, or deposited by the wind, as sand dunes.

ephemeral stream - A stream that flows occasionally because of surface runoff, and is not influenced by permanent ground water.

erosion - The wearing away of the land surface by running water, wind, ice or other geologic agents.

evapotranspiration - The sum total of water lost from the land by evaporation and plant transpiration.

excavation (archeological) - The scientifically controlled recovery of subsurface materials and information from a cultural site. Recovery techniques are relevant to research problems and are designed to produce maximum knowledge about the site's use, its relation to other sites and the natural environment, and its significance in the maintenance of the cultural system.

fair market value (FMV)- The amount in cash, or in terms reasonably equivalent to cash, for which in all probability a coal deposit would be sold or leased by a knowledgeable owner willing but not obligated to sell or lease to a knowledgeable purchaser who desires but is not obligated to buy or lease.

forage - Vegetation used for food by wildlife, particularly big game wildlife, and domestic livestock.

formation (geologic) - A rock body distinguishable from other rock bodies and useful for mapping or description. Formations may be combined into groups or subdivided into members.

fossil - The remains or traces of an organism or assemblage of organisms that have been preserved by natural processes in the earth's crust. Many minerals that may be of biologic origin are not considered to be fossils (e.g. oil, gas, asphalt, limestone).

geometric mean - The nth root of the product of the values of n positive numbers.

global warming - An average increase in the Earth's temperature, which in turn causes changes in climate.

greenhouse effect - A theory that certain gases in the atmosphere impede the release of radiation from the earth, trapping heat in the atmosphere like glass over a greenhouse.

groundwater - Subsurface water that fills available openings in rock or soil materials to the extent that they are considered water saturated.

habitat - A place where a plant or animal naturally or normally lives and grows.

hazardous materials - Substance which, because of its potential for corrosivity, toxicity, ignitability, chemical reactivity, or explosiveness, may cause injury to persons or damage to property.

hazardous waste - Those materials defined in Section 101 (14) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, and listed in 40 CFR § 261. A used or discarded material that can damage the environment and be harmful to health. Hazardous wastes include heavy metals and toxic chemicals used in industrial products and processes as well as infectious medical wastes and radioactive materials such as spent nuclear fuel rods.

human environment - The natural and physical environment in which humans preside or have an impact and the relationship of people with the surrounding environment (see 30 CFR 1508.14).

hydraulic conductivity - The capacity of a medium to transmit water; permeability coefficient. Expressed as the volume of water at the prevailing temperature that will move in unit time under a unit hydraulic gradient through a unit area. Units include gallons per day per square foot, centimeters per second.

hydraulic - Pertaining to fluid in motion, or to movement or action caused by water.

hydric soil - A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic (water-loving) vegetation. Hydric soils that occur in areas having positive indicators of hydrophytic vegetation and wetland hydrology are wetland soils.

hydrocarbon - Any organic compound, gaseous, liquid, or solid, consisting solely of carbon and hydrogen.

hydrology - The science dealing with the behavior of water as it occurs in the atmosphere, on the surface of the ground, and underground.

impermeable - Not capable of transmitting fluids or gasses in appreciable quantities.

incised - Having a margin that is deeply and sharply notched.

indirect (or secondary) impact - A reasonably foreseeable impact resulting from an action but occurring later in time than or removed in distance from that action (see 40 CFR 1508.8).

in-place coal reserves - The estimated volume of all of the coal reserves in a lease without considering economic or technological factors that might restrict mining.

in-situ leach mining (ISL) - Removal of the valuable components of a mineral deposit through chemical leaching without physical extraction of the rock. (ISL), also called **in-situ recovery** (ISR) or **solution mining**, is a process of recovering minerals such as copper and uranium through boreholes drilled into the deposit. The process initially involves drilling of holes into the ore deposit. Explosive or hydraulic fracturing may be used to create open pathways in the deposit for solution to penetrate. Leaching solution is pumped into the deposit where it makes contact with the ore. The solution bearing the dissolved ore content is then pumped to the surface and processed. This process allows the extraction of metals and salts from an ore body without the need for conventional mining involving drill-and-blast, open-cut or underground mining.

interbedded - Layers of one type of rock, typically thin, that are laid between or that alternate with layers of another type of rock.

interburden - A layer of sedimentary rock that separates two mineable coal beds.

interdisciplinary - Characterized by participation or cooperation among two or more disciplines or fields of study.

intermittent stream - A stream that does not flow year-round but has some association with ground water for surface or subsurface flow.

laminated - Consolidated or unconsolidated sediment that is characterized by thin (less than 1 cm thick) layers.

lead agency - The agency or agencies preparing or having taken primary responsibility for preparing an environmental document (see 40 CFR 1508.16).

lease (mineral) - A legal document executed between a mineral owner or lessor and another party or lessee which grants the lessee the right to extract minerals from the tract of land for which the lease has been obtained [see 43 CFR 3400.0-5(r)].

lek - A traditional breeding area for grouse species where territorial males display and establish dominance.

lenticular - Term describing a body of rock or earth that thins out in all directions from the center like a double convex optical lens.

limb (geologic) - One side of a fold (syncline or anticline).

limestone - A sedimentary rock consisting chiefly of calcium carbonate.

lineament - A linear topographic feature of regional extent that is believed to reflect crustal structure.

loadout facilities - The mine facilities used to load the mined coal for transport out of the mine.

loam - A rich, permeable soil composed of a mixture of clay, silt, sand, and organic matter.

maintenance tract - A federal coal tract that would continue or extend the life of an existing coal mine.

major federal action - An action with effects that may be major and which is potentially subject to federal control and responsibility (see 40 CFR 1508.18).

major sources – Those sources that emit more than 10 tons per year of any single hazardous air pollutant, or 25 tons of all hazardous air pollutants combined. The determination of major is based on all sources of hazardous air pollutants at the site, and not just the equipment affected by the MACT standard.

maximum economic recovery (MER) - The requirement that, based on standard industry operating practices, all profitable portions of a leased federal coal deposit must be mined. MER determinations will consider existing proven technology; commercially available and economically feasible equipment; coal quality, quantity, and marketability; safety, exploration, operating, processing, and transportation costs; and compliance with applicable laws and regulations [see 43 CFR 3480.0-5(a)(24)].

meteorological - Related to the science dealing with the atmosphere and its phenomena, especially as relating to weather.

methane - A colorless, odorless, and flammable gaseous hydrocarbon; the simplest hydrocarbon; chemical formula = CH_4. It is the product of decomposition of organic matter and of the carbonization of coal, is used as a fuel and as a starting material in chemical synthesis, and is the simplest of the alkanes, constituent of natural gas and is also found associated with crude oil and coal.

mineable coal - Coal that can be economically mined using present day mining technology.

mineral rights - The rights of one who owns the mineral estate (subsurface).

mining permit - A permit to conduct surface coal mining and reclamation operations issued by the state regulatory authority pursuant to a state program or by the Secretary pursuant to a federal program (see 30 CFR 701.5).

mitigation - An action to avoid, minimize, reduce, eliminate, replace, or rectify the impact of a management practice.

mudstone - A hardened sedimentary rock consisting of clay. It is similar to shale but lacks distinct layers.

National Register of Historic Places (NRHP) - A list of districts, sites, buildings, structures and objects significant in American history, architecture, archeology and culture maintained by the Secretary of the Interior. Expanded as authorized by Section 2(b) of the Historic Sites Act of 1935 (16 U.S.C. 462) and Section 101(a)(1) (A) of the National Historic Preservation Act.

native species – Native species refer to wild animals and plants that have evolved in a particular region and environment. Native species are the most adapted to the area and are more disease and drought resistant than non-native species. Native plants provide the greatest benefits to wildlife because the native wildlife evolved with native plants. Often the food provided by native plants is the most nutritious to our native wildlife.

natural gas - Combustible gases (such as hydrocarbons) or mixtures of combustible gases and non-combustible gases (such as helium) that are in a gaseous phase at atmospheric conditions of temperature and pressure.

NEPA process - All measures necessary for compliance with the National Environmental Policy Act of 1969 (see 40 CFR 1508.21).

No Action Alternative - An alternative where no activity would occur. The development of a no action alternative is required by regulations implementing

the National Environmental Policy Act (40 CFR 1502.14). The No Action Alternative provides a baseline for estimating the effects of other alternatives.

outcrop - A rock formation that appears at or near the surface; the intersection of a rock formation with the surface.

overburden - Overburden is the term used in mining to describe material that lies above (excluding topsoil) the area of economic interest, *e.g.*, the rock and soil that lies above the coal seam. Also known as 'waste'. Overburden is distinct from tailings, the material that remains after economically valuable components have been extracted from the generally finely milled ore. Overburden is removed during surface mining, but is typically not contaminated with toxic components and may be used to restore a mining site to a semblance of its appearance before mining began. Overburden may also be used as a term to describe all soil and ancillary material above the bedrock horizon in a given area.

oxides of nitrogen (NO_x) - The generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts.

ozone - A gas that is created by a chemical reaction between oxides of nitrogen (NOx) and volatile organic compounds (VOC) in the presence of sunlight; chemical formula = O_3.

paleontological resource - A site containing evidence of plant or non-human animal life of past geological periods, usually in the form of fossil remains.

peak discharge or flow - The highest discharge of water recorded over a specified period of time at a given stream location; also called maximum flow. Often thought of in terms of spring snowmelt, summer, fall or winter rainy season flows.

perennial species (vegetation) - Vegetation that lives over from season to season.

perennial stream - A stream or part of a stream that flows continuously during the calendar year as a result of groundwater discharge or surface runoff.

permeability - The ability of rock or soil to transmit a fluid.

permit application package - A proposal to conduct surface coal mining and reclamation operations on federal lands, including an application for a permit, permit revision, or permit renewal and all the information required by SMCRA, the applicable state program, any applicable cooperative agreement, and all other applicable laws and regulations including, with respect to federal leased coal, the Mineral Leasing Act and its implementing regulations.

permit area - The area of land, indicated on the approved map submitted by the operator with his or her application, required to be covered by the operator's performance bond under the regulations at 30 CFR Part 800 and which shall include the area of land upon which the operator proposes to conduct surface coal mining and reclamation operations under the permit, including all disturbed areas (see 30 CFR 701.5).

physiography - Physical geography.

playa - The sandy, salty, or mud-caked flat floor of a basin with interior drainage, usually occupied by a shallow ephemeral lake during or after rain or snow storms.

point source (pollution) - A point at which pollution is added to a system, either instantaneously or continuously. An example is a smokestack.

pore volume - The amount of fluid necessary to fill the void space in an unsaturated porus medium (i.e., mine backfill).

porosity - The percentage of the bulk volume of rock, sediment or soil that is not occupied by sediment or soil particles; the void space in rock or sediment. It may be isolated or connected.

postmining topography - The relief and contour of the land that remains after mining has been completed.

potentiometric surface - The surface that coincides with the static level of water in an aquifer. The surface is represented by the levels to which water from a given aquifer will rise under its full hydraulic head.

predator - An animal that obtains food by killing and consuming other animals.

prime or unique farmland - Those lands which are defined by the Secretary of Agriculture in 7 CFR part 657 (*Federal Register* Vol. 4 No. 21) and which have historically been used for cropland (see 30 CFR 701.5).

proposed action - In terms of National Environmental Policy Act, the project, activity, or action that a federal agency proposes to implement or undertake and which is the subject of an environmental analysis.

qualified surface owner - The natural person or persons (or corporation, the majority stock of which is held by a person or persons otherwise meeting the requirements of this section) who:

(1) hold legal or equitable title to the surface of split estate lands;

(2) have their principal place of residence on the land, or personally conduct farming or ranching operations upon a farm or ranch unit to be affected by surface mining operations; or received directly a

significant portion of their income, if any, from such farming and ranching operations; and

(3) have met the conditions of (1) and (2) above for a period of at least three years, except for persons who gave written consent less than three years after they met the requirements of both (1) and (2) above [see 43 CFR 3400.0-5(gg)].

raptor - Bird of prey, such as an eagle, falcon, hawk, owl, or vulture.

recharge - The processes by which groundwater is absorbed into a zone of saturation.

reclamation - Rehabilitation of a disturbed area to make it acceptable for designated uses. This normally involves regrading, replacement of topsoil, revegetation (with native plant life) and other work necessary to restore the disturbed area for post-mining use. In general where viable an attempt to put the terrain back to the pre-mining contours is also of paramount importance.

record of decision (ROD) - A document separate from, but associated with, an environmental impact statement that publicly and officially discloses the responsible official's decision on the proposed action (see 40 CFR 1505.2).

recoverable coal - The amount of coal that (is economically feasible to recover) can actually be recovered for sale from the demonstrated coal reserve base.

rental payment - Annual payment from a lessee to a lessor to maintain the lessee's mineral lease rights.

resource management plan (RMP) - A land use plan, as prescribed by FLPMA, that directs the use and allocation of public lands and resources managed by BLM. Prior to selection of the RMP, different alternative management plans are compared and evaluated in an environmental impact statement (EIS) to determine which plan will best direct the management of the public lands and resources.

revegetation - The reestablishment and development of self-sustaining plant cover following land disturbance. This may occur through natural processes, or the natural processes may be enhanced by human assistance through seedbed preparation, reseeding, and mulching.

right of way (ROW) - The right to pass over property owned by another. The strip of land over which facilities such as roadways, railroads, or power lines are built.

riparian - The area adjacent to rivers and streams that lies between the stream channel and upland terrain and that supports specific vegetation influenced by perennial and/or intermittent water.

royalty (mineral) - A share of production that is free of the expense of production. It is generally paid by a lessee to a lessor of a mineral lease as part of the terms of the lease.

runoff - That portion of rainfall that is not absorbed; it may be used by vegetation, lost by evaporation, or it may find its way into streams as surface flow.

salinity - Refers to the solids, such as sodium chloride (table salt) and alkali metals, that are dissolved in water. Often in non-saltwater areas, total dissolved solids is used as an equivalent term.

sandstone - A common sedimentary rock primarily composed of sand grains, mainly quartz, that are cemented together by other mineral material.

scoping - A public informational process required by the National Environmental Policy Act to determine private and public concerns, scope of issues, and/or questions regarding a proposed action to be evaluated in an environmental impact analysis.

scoria (clinker) - Baked and fused rock resulting from in-place burning of coal deposits.

sedimentation pond - An impoundment used to remove solids from water in order to meet water quality standards or effluent limitations before the water leaves the permit area (see 30 CFR 701.5).

semi-arid - A climate or region characterized by little yearly rainfall and by the growth of a number of short grasses and shrubs.

severance tax - A tax on the removal of minerals from the ground.

shale - A very fine-grained clastic rock or sediment consisting predominately of clay-sized particles that is laminated; lithified, layered mud.

significant impact - A qualitative term used to describe the anticipated importance of impacts to the human and or the environment as a result of an action(s) either direct or indirect.

siltstone - A fine-grained clastic rock consisting predominately of silt-sized particles.

socioeconomics - The social and economic situation that might be affected by a proposed action.

soil survey - The systematic examination, description, classification, and mapping of soils in an area, usually a county. Soil surveys are classified

according to the level of detail of field examination. Order I is the most detailed and Order V is the least detailed.

split estate situation – Situations where the surface rights and subsurface rights (such as the rights to develop minerals) for a piece of land are owned by different parties.

spontaneous combustion – The heating and slow combustion (self-ignition) of coal and coaly material initiated through chemical action (as oxidation (absorption of oxygen)).

stipulations - Requirements that are part of the terms of a mineral lease. Some stipulations are standard on all Federal leases. Other stipulations may be applied to specific leases at the discretion of the surface management agency to protect valuable surface resources or uses existing on those leases.

storage coefficient - The volume of water that can be released from storage per unit surface area of a saturated confined aquifer, per unit decline in the component of hydraulic head normal to the surface. It is calculated by taking the product of the specific storage and the aquifer thickness.

stratigraphic - Of, relating to, or determined by stratigraphy, which is the branch of geology dealing with the study of the nature, distribution, and relations of layered rocks in the earth's crust.

stripping ratio - The unit amount of overburden that must be removed to gain access to a similar unit amount of coal.

subirrigation - In alluvial valley floors, the supplying of water to plants from underneath, or from a semi-saturated or saturated subsurface zone where water is available for use by vegetation (see 30 CFR 701.5).

subbituminous - A lower rank of coal (35-45 percent carbon) with a heating value between that of bituminous and lignite, usually 8,300-11,500 Btu per pound. Sub bituminous coal contains a high percentage of volatile matter and moisture.

surface disturbance - Any disturbance by direct or indirect actions that alters the soil surface.

surface rights - Rights to the surface of the land, does not include rights to oil, gas, or other subsurface minerals or subsurface rights.

suspended solids - The very fine soil particles that remain in suspension in water for a considerable period of time without contact with the stream or river channel bottom.

tectonic fracture - Fractures caused by deformation of the earth's crust.

threatened and endangered (T&E) species - These species of plants or animals classified as threatened or endangered pursuant to Section 4 of the Endangered Species Act. Any species which is in danger of extinction, or is likely to become so within the foreseeable future.

> ***Category 1*** - Substantial biological information on file to support the appropriateness of proposing to list as endangered or threatened.
>
> ***Category 2*** - Current information indicates that proposing to list as endangered or threatened is possibly appropriate, but substantial biological information is not on file to support an immediate ruling (U.S. Fish and Wildlife Service).

topography - Physical shape of the ground surface; the configuration of land surface including its relief, elevation, and the position of its natural and manmade features.

topsoil - The upper portion of a soil, usually dark colored and rich in organic material. It is more or less equivalent to the upper portion of an A horizon in an ABC soil.

total dissolved solids (TDS) - The total quantity in milligrams per liter of dissolved materials in water.

transmissivity - The rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient. Equals the hydraulic conductivity multiplied by the aquifer thickness. Values are given in units of gallons per day per foot.

transpiration - The discharge of water vapor by plants.

truck & shovel - A mining method used to remove overburden and coal in a strip mining operation. Truck and shovel operations use large bucket-equipped digging and loading machines (shovels) and large dump trucks to remove overburden instead of using a dragline for overburden removal.

unconfined aquifer - An aquifer where the water table is exposed to the atmosphere through openings in the overlying materials.

unsuitability criteria - The 20 criteria described in 43 CFR 3461, the application of which results in an assessment of federal coal lands as suitable or unsuitable for surface coal mining.

uranium - A very hard, heavy, metallic element that is crucial to development of atomic energy.

vegetation type - A kind of existing plant community with distinguishable characteristics described in terms of the present vegetation that dominates an area.

vertebrate fossils - The fossilized remains of animals that possessed a backbone; examples are fish, amphibians, reptiles, dinosaurs, birds, and mammals.

vesicular - Rock containing many small cavities that were formed by the expansion of a bubble of gas or steam during the solidification of the rock.

visual resources - The physical features of a landscape that can be seen (e.g., land, water, vegetation, structures, and other features).

Visual Resource Management (VRM) - The systematic means to identify visual values, establish objectives which provide the standards for managing those values, and evaluate the visual impacts of proposed projects to ensure that objectives are met.

volatile organic compound (VOC) - Organic chemical compounds that have high enough vapor pressures under normal conditions to significantly vaporize and enter the atmosphere.

waterfowl - A bird that frequents water, especially a swimming bird such as a duck or swan.

wetlands - Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient, under normal circumstances, to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands include marshes, bogs, sloughs, potholes, river overflows, mud flats, wet meadows, seeps, and springs [see 33 CFR 328.3(a)(7)(b)].

wild and scenic river - Rivers or sections of rivers designated by Congressional actions under the 1968 Wild and Scenic Rivers Act as wild, scenic, or recreational by an act of the Legislature of the state or states through which they flow. Wild and scenic rivers may be classified and administered under one or more of the following categories:

> **wild river areas** - Rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.
>
> **scenic river areas** - Rivers or sections of rivers that are free of impoundments, with watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.
>
> **recreational river areas** - Rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along

their shorelines, and that may have undergone some impoundment or diversion in the past.

wilderness - An area of undeveloped Federal land designated wilderness by Congress, retaining its primeval character and influence, without permanent improvements or human habitation, protected and managed to preserve its natural conditions and that (1) generally appears to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable, (2) has outstanding opportunities for solitude or primitive and unconfined recreation, (3) has at least 5,000 acres or is of sufficient size to make practical its preservation and use in an unimpaired condition, and (4) also may contain features that are of ecological, geological, scientific, educational, scenic, or historical value. These characteristics were identified by Congress in the Wilderness Act of 1964.

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